WATER SUPPLY MANAGEMENT PROGRAM

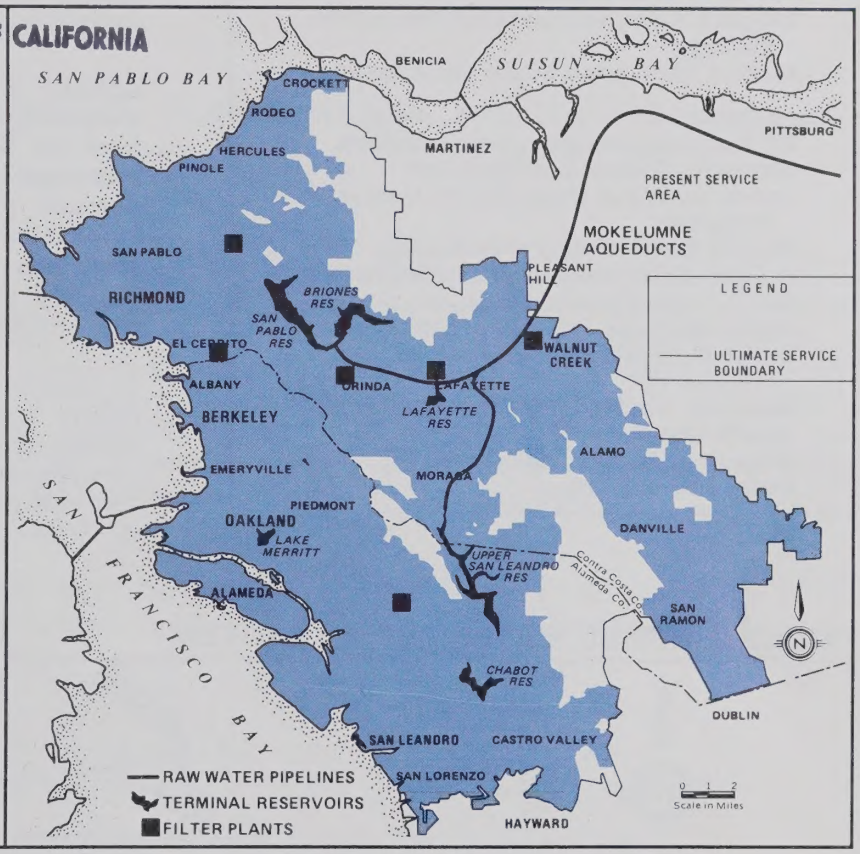
EBMUD

SUMMARY

APRIL 1988

KEY ISSUES AFFECTING WATER SUPPLY:

- SECURITY
- SHORTAGE
- SAFETY AND HEALTH



PURPOSE

The East Bay Municipal Utility District for more than 58 years has provided a dependable supply of high quality water to meet the needs of the growing population in the East Bay service area. The water supply has been available even in times of drought and crisis---although there was drought rationing in 1977 and a close call in 1980 when flood waters threatened the three aqueduct pipelines in the Delta.

The District is developing a Water Supply Management Program to identify the actions and projects necessary to continue to provide a dependable water supply for meeting the needs of the cities, communities, and people it serves.

This Summary covers a technical report and a draft environmental impact report prepared for the Water Supply Management Program. As part of a continuing public review, comments are being solicited on the proposed program described in this Summary and in the reports.

INSIDE THIS SUMMARY:

SEE BACK PAGE FOR MORE INFORMATION ABOUT PARTICIPATING IN THE PUBLIC REVIEW PROCESS

ACKNOWLEDGEMENT

The technical report and this summary were prepared by EBMUD staff with the assistance of the consultants listed below.

EBMUD Principal Staff

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Melissa Blanton, Editor

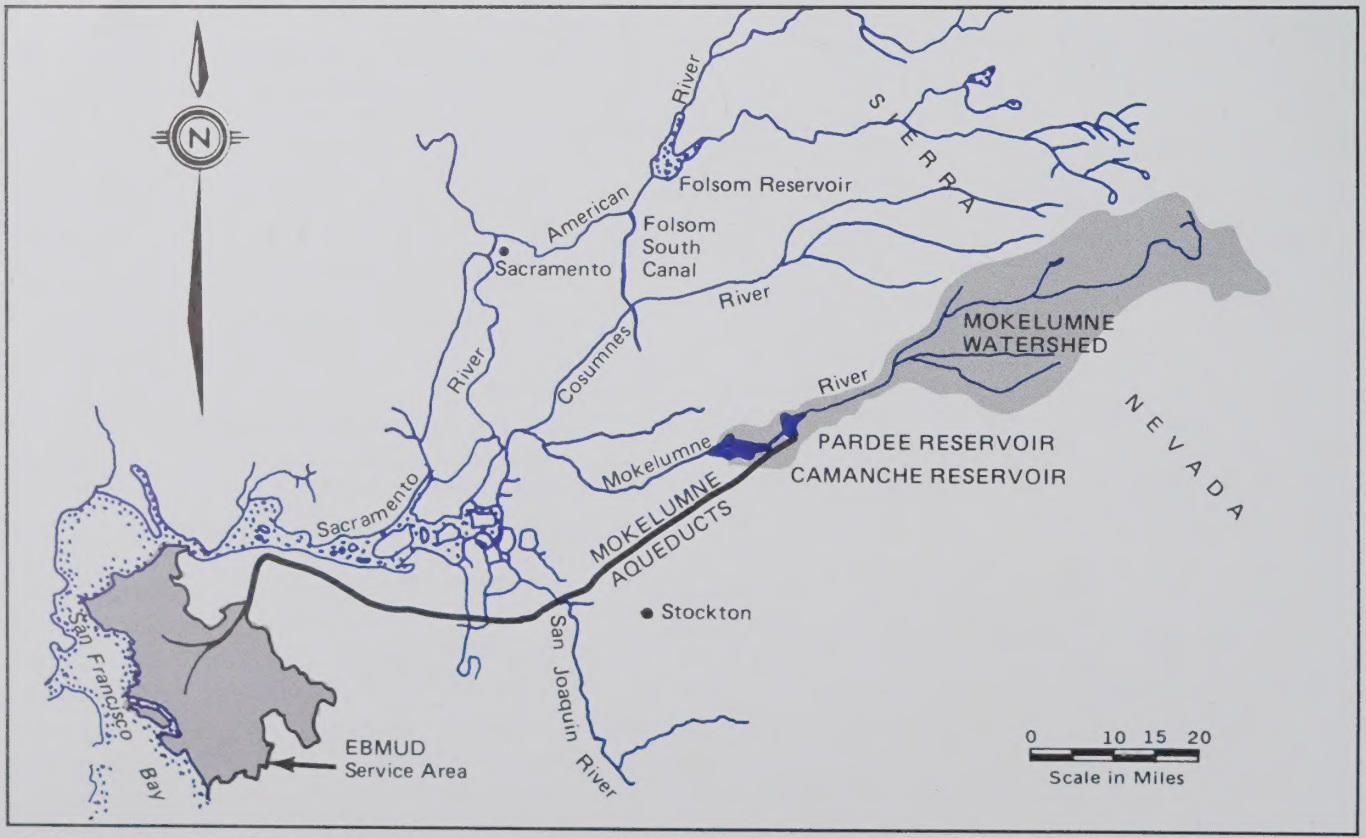
INTRODUCTION

EBMUD's water supply system, shown in Figure 2, was originally constructed in the 1920's, with subsequent additions as the service area grew. No additions have been constructed since the mid-1960s although there has been a 20 percent growth in the number of customers and a 30 percent increase in water demand.

EBMUD is facing a series of problems: (1) an increasing risk of failure of the aqueduct pipelines from the Sierras, (2) an increasing frequency of shortage in dry periods because of a water demand that is gradually increasing despite significant reductions in water use by many customers, and (3) a need for continued vigilence to protect water quality against pollution and contamination.

To identify the security, shortage, and safety and health needs, the District's staff with the assistance of engineering and environmental consultants (see box at left) has conducted many technical and environmental investigations.

FIGURE 2 EBMUD WATER SUPPLY SYSTEM



EBMUD supplies water to 1.1 million people in portions of Alameda and Contra Costa Counties. The cities and communities in the service area are shown on the map on the front cover.

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EAST BAY MUNICIPAL UTILITY DISTRICT
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April 29, 1988

TO: Interested Agencies, Organizations, and Individuals

SUBJECT: Water Supply Management Program

EBMUD is developing a Water Supply Management Program to identify the actions and projects necessary to continue to provide a dependable water supply for meeting the needs of the cities, communities, and people it serves. The enclosed Summary, Technical Report, and Draft Environmental Impact Report describe the problems, alternative solutions, and program proposal by EBMUD staff, and are being distributed for review and comment. The Draft EIR is in conformance with the requirements of the California Environmental Quality Act (CEQA) and State Guidelines.

Comments on the reports may be made at the scheduled public meeting and hearing, and may be submitted in writing as follows:

PUBLIC MEETING CONDUCTED BY STAFF:
WEDNESDAY, MAY 18, 1988, 7:30 P.M.
EBMUD Administration Center -- Room 100
2130 Adeline Street, Oakland

PUBLIC HEARING BY EBMUD BOARD OF DIRECTORS:
WEDNESDAY, MAY 25, 1988, 7:30 P.M.
Kaiser Center Auditorium
300 Lakeshore Drive, Oakland

SUBMIT WRITTEN COMMENTS BY FRIDAY, JUNE 17, 1988 TO:
Richard L. Kolm, Assistant Chief Engineer for Planning
EBMUD, P.O. Box 24055, Oakland, CA 94623

For accuracy of record, written comments are desirable and encouraged. The comments should be supported by factual information whenever possible. Each agency or organization submitting comments is requested to include the name of its contact person. Comments received on the Draft EIR will be included and considered in the Final EIR.

Very truly yours,

C. T. Way

C. T. Way

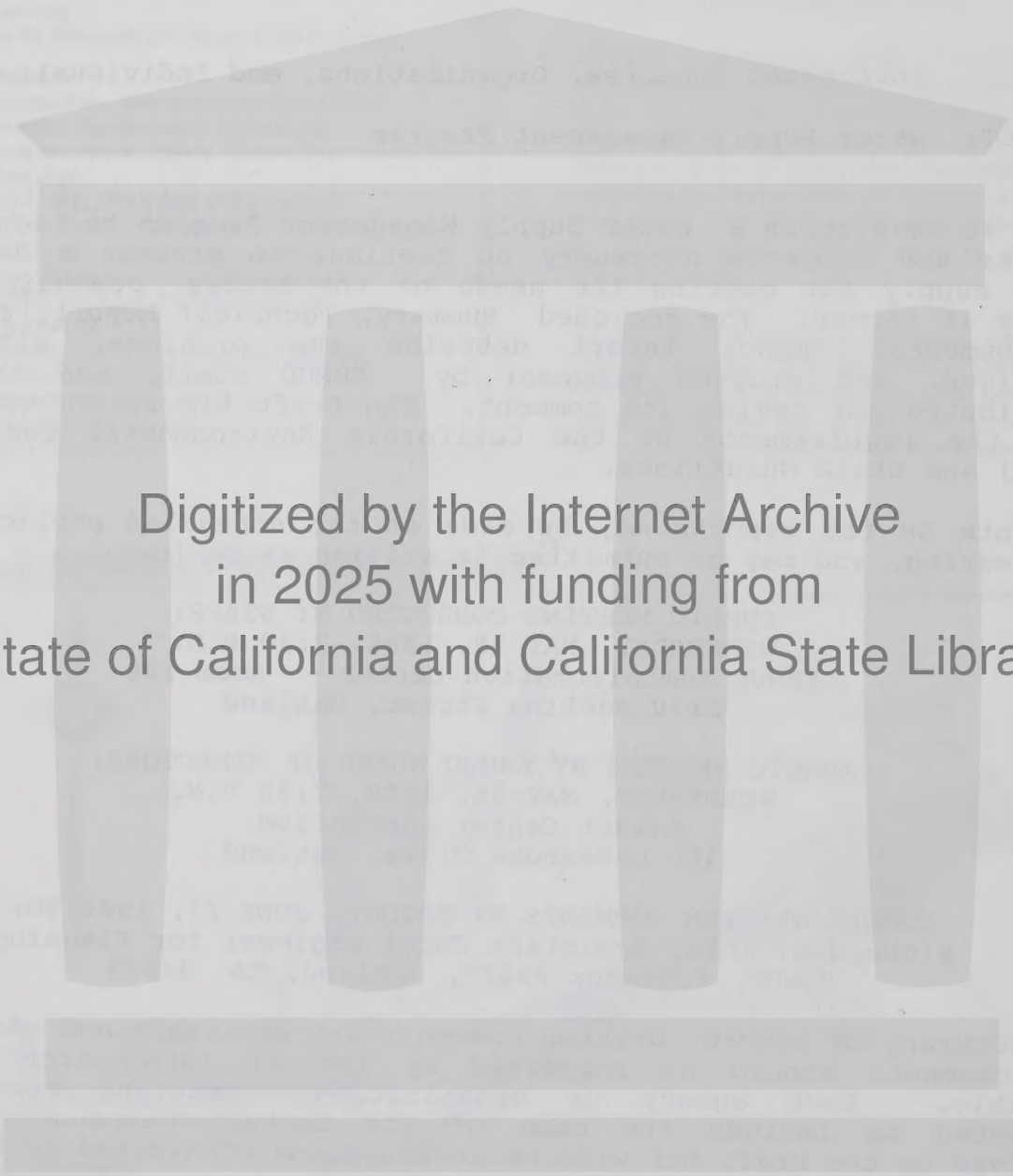


TABLE 1. WATER SUPPLY MANAGEMENT PROGRAM OVERVIEW

ISSUE	PROBLEM	SOLUTION	OBJECTIVE
Security	Pipeline Breaks	Water Banking	**Security** against Floods and Earthquakes
Shortage	Drought	Banking and Conservation	**Supply** to Meet Dry Year Demands
Safety and Health	Pollution and Contamination	Watershed and Treatment Improvements	Maintain High **Qualilty** Water

Among the various concepts proposed in response to the water supply problems is the connection of the District's system to an additional source of supply. Although EBMUD has had a contract with the Bureau of Reclamation since 1970 for a supplemental supply from the American River, it has not constructed the facilities to be able to use it because of litigation. The long history of this litigation appears to be drawing to a close. If it is resolved in the District's favor, it may be possible to connect to this new source within the next decade. The proposed Water Supply Management Program covers needed water system improvements which can proceed with or without the American River supply.

In defining the issues and problems summarized in Table 1, EBMUD staff made many assumptions about the future, considering a wide range of alternatives and developing a broad range of program costs. Staff findings have now been compiled in report form for review and comment by the public and for action by the Board of Directors. Because of the variety of viewpoints about the actions and projects needed and because program costs will be shared by existing ratepayers and new customers, extensive public involvement is being solicited.

Based on investigations and studies, it appears that the best apparent solution to EBMUD's water supply problems will involve some combination of three major elements: water banking, conservation, and watershed improvement.

Water Banking

Water banking is achieved by maintaining water in local storage reservoirs to help meet demand during short disruptions or extended outages of the normal supply from the Mokelumne River. Another application is storage of winter and spring runoff for use during the high-demand summer period. Although there are significant major terminal reservoirs in the East Bay area, additional storage would provide security of the water supply against aqueduct pipeline breaks in the Delta caused by a flood or earthquake disaster and would accommodate the projected increase in demand and reduce the severity of rationing during a drought.

Water Conservation

Water conservation means the efficient use of existing supplies, regardless of their magnitude. Since beginning its pioneering efforts in the early 1970s, EBMUD has had a proactive water conservation program leading the nation in water conservation education and the state in legislation. Continued emphasis on water conservation and other water-efficient measures such as reclamation and reuse will be a necessary part of any Water Supply Management Program.

Watershed Improvement

The District has an obligation to protect the public health by providing the highest quality water available. Coupled with EBMUD's position that the use of water from the Sacramento-San Joaquin Delta is not acceptable from a long-term public health standpoint, the need for continued monitoring and controlling of activities affecting the Mokelumnne and the terminal storage watersheds is essential. Watershed management would be improved by EBMUD's purchase of watershed lands currently in other ownership and which may have a potential for development.

A PUBLIC PROCESS

EBMUD must consider the impact of its proposed program on the area it serves: 20 cities, 15 communities, and 1.1 million people. Last year, the District solicited comments on a discussion paper describing the preliminary elements of the program being developed. The comments received during that public review process were considered in the preparation of the program presently being proposed.

Public Briefings by EBMUD Staff

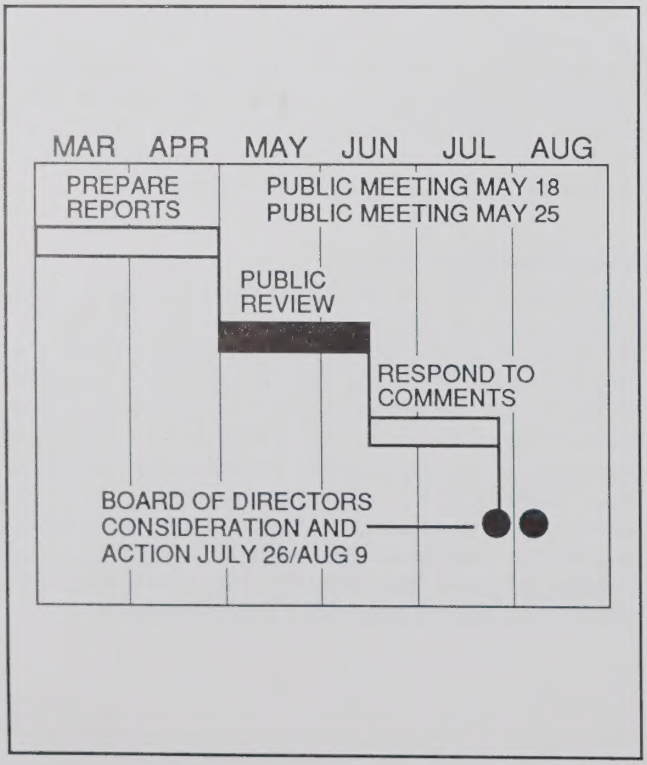
In addition to the public comment period in 1987 and the public hearings and meetings scheduled for this spring (see back cover), EBMUD staff has made a concerted effort to brief agencies and organizations on the key issues and needs and to respond to different viewpoints about the program.

Board Action

The Board of Directors' consideration of the reports, public input, and action on the proposed Water Supply Managment Program is tentatively scheduled for the summer of 1988. The actions would include:

- Acceptance of the technical report.
- Certification of the Final EIR as completed for the Water Supply Management Program.

FIGURE 3. PUBLIC INVOLVEMENT SCHEDULE



- Adoption of the Water Supply Management Program:
  - Water supply objectives
  - Program elements
  - Specific projects and actions

Future Action

Construction of any facilities approved as part of the program could require an additional sequence of actions, such as the following:

- Additional geotechnical investigation.
- Field testing of conservation techniques and pilot tests.
- Application to the Corps of Engineers for a permit under Section 404 of the Clean Water Act.
- Coordination with cities, counties, and other agencies regarding the impacts of construction and construction traffic.
- Design of the facilities and preparation of plans and specifications.
- Competitive bidding and award of construction contracts.

SECURITY: PROTECT AGAINST FLOODS AND EARTHQUAKES

EBMUD's water supply system is increasingly vulnerable to natural disasters that could severely damage facilities and result in a water supply outage. The system is particularly vulnerable where the Mokelumne Aqueduct pipelines cross the Sacramento-San Joaquin Delta Region.

EXISTING CONDITIONS

The Delta

There is a long history of levee failures in the Delta, including the region where the Mokelumne Aqueducts are located. The peat and sandy soils on which the levees were built and the poor quality of levee construction have made the levees very vulnerable to failures caused by sloughing, erosion, overtopping, and earthquakes.

The islands and tracts are 10 to 15 feet below sea level, and the ground is generally subsiding at a rate of 2 to 3 inches each year. The levees are subsiding 1.5 to 2 inches per year. The ongoing subsidence increases the need for continued levee maintenance and upgrading.

EBMUD has strongly supported levee maintenance and improvements on the islands and tracts crossed by the Mokelumne Aqueducts. Over the past four years it has contributed more than $1 million toward the work of the reclamation districts to protect against 50-year floods. Studies by the U. S. Corps of Engineers and the State Department of Water Resources in 1982 identified the serious problems with levees in the Delta and recommended various levels of improvements. There have been efforts in the State Legislature to provide financing for the high cost of major levee improvements. Despite these activitites, it is expected that future levee failures will occur with increasing frequency. (See the map of historic Delta flooding on page 7.)

Mokelumne Aqueducts

The stake the District has in Delta levee protection was made clear in 1980 when Lower Jones Tract flooded and the railroad embankment adjacent to the aqueducts subsequently failed, allowing floodwaters to flow into Upper Jones Tract. Although there was deep scour around the pipe support piling, the pipes were not damaged due to two fortuitous circumstances: The flow through the break was reduced by the low water level on Lower Jones Tract and was deflected by two locomotives and a box car that fell off of the railroad embankment.

Such conditions cannot be counted upon in the future, and serious consideration must be given to the vulnerability of the Mokelumne Aqueducts, both to future levee failures and to earthquakes.

FIGURE 4. MOKELUMNE AQUEDUCTS IN THE DELTA

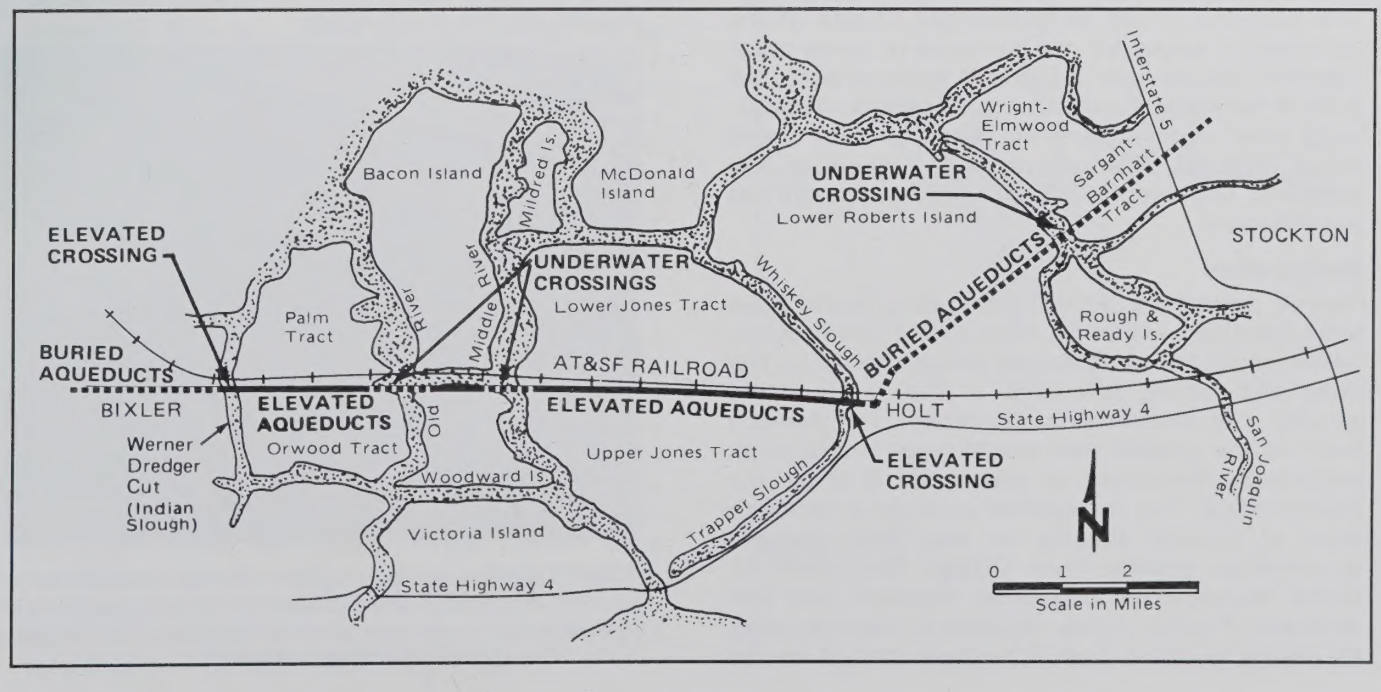
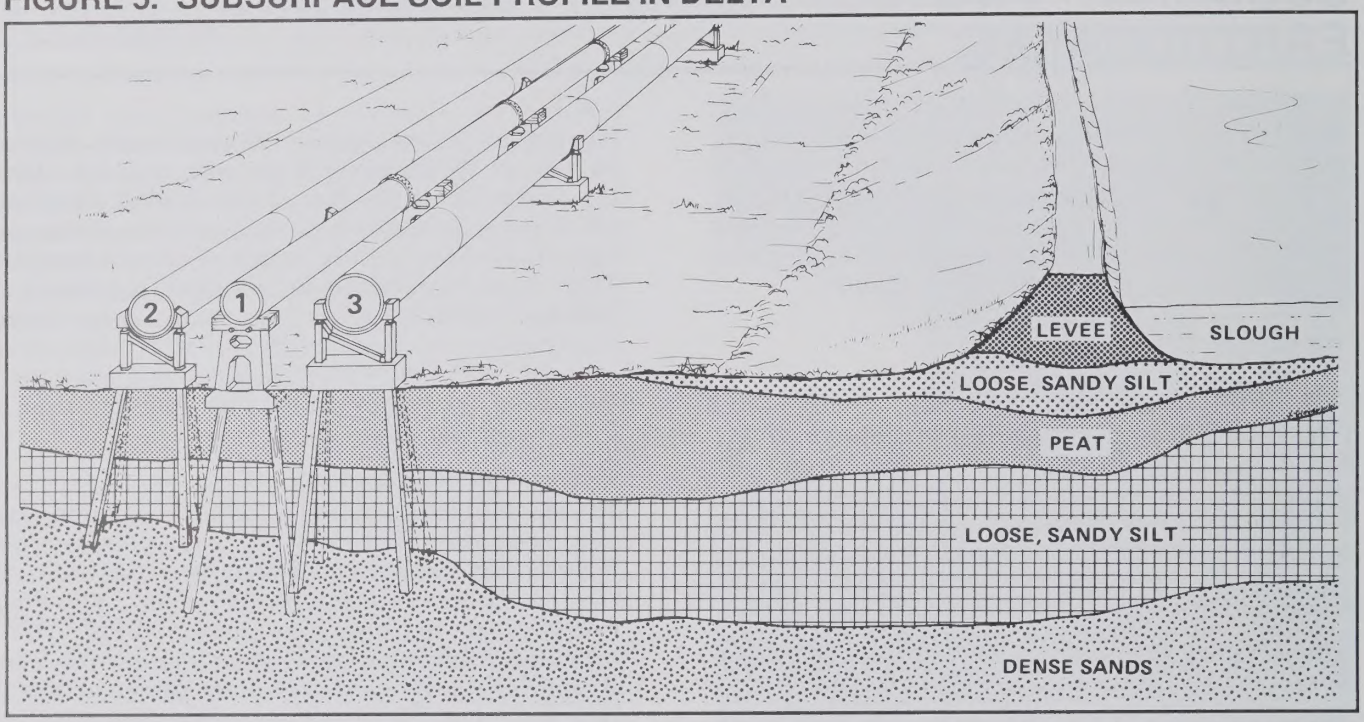


FIGURE 5. SUBSURFACE SOIL PROFILE IN DELTA



The Mokelumne Aqueducts are elevated above ground for 9 miles. The loose composition of Delta soils make the aqueducts vulnerable to floods.

VULNERABILITY OF AQUEDUCTS

Future Levee Failures

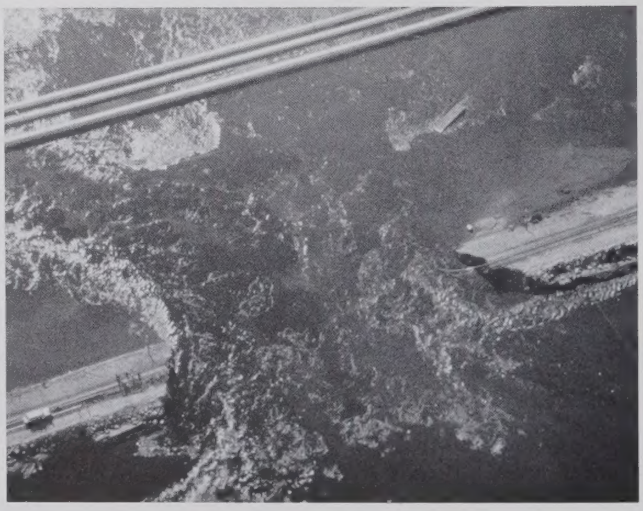
If a levee break occurs near the elevated pipelines (Figure 5), the scour caused by water rushing inland through the break could undermine the pile supports and cause the pipelines to collapse.

Even if the pipelines do not collapse, inundation of an island or tract is a hazard because the pipelines and supports would be submerged. If one of the pipelines is empty for maintenance or some other reason it would have a bouyant force trying to lift it off of its supports, which could result in damage. Long term inundation of an island or tract would cause physical deterioration of the pipelines and supports and would prevent access for normal maintenance.

Earthquakes

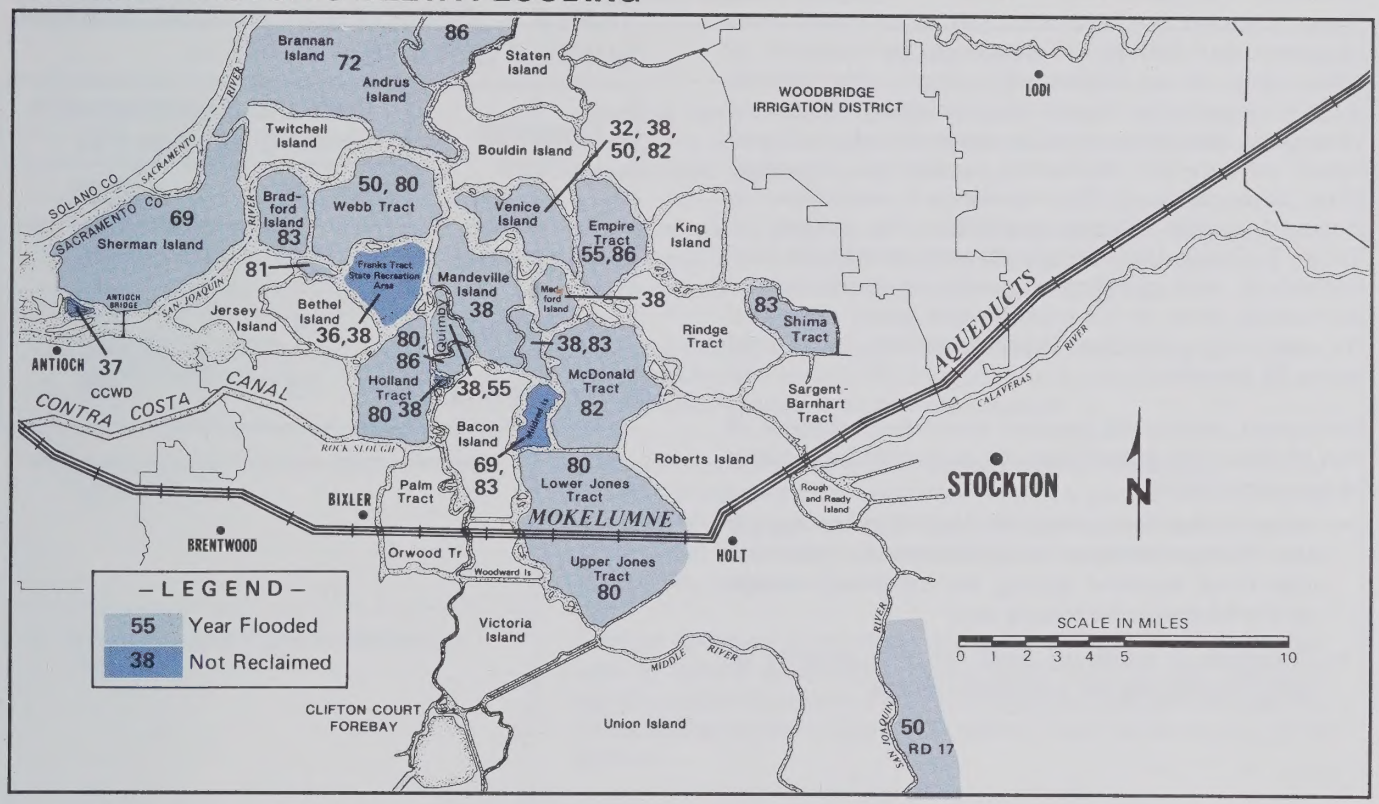
Twelve potentially active earthquake faults have been identified within 50 miles of the Delta region, which could cause damaging ground shaking. The deep and rather soft soils in the Delta would amplify any seismic ground motion. The Antioch Fault is the closest and would have a maximum earthquake estimated at magnitude 6-½ on the Richter scale. This is expected to cause a very high level of ground shaking in the Delta (ground acceleration greater than 0.25g). The other 11 faults, including the Calaveras, Hayward, and San Andreas Faults, have maximum earthquakes estimated to range from 6 to more than 8 on the Richter scale. Because of their greater distance from the Delta they would cause low to moderate ground shaking (acceleration between 0.1 and 0.2g).

FIGURE 6. 1980 JONES TRACT FLOOD AND SUBSEQUENT RAILROAD EMBANKMENT FAILURE



EBMUD pipelines at top of photo survived because of reduced flows through levee caused by low water levels and deflection due to presence of two locomotives and a box car. (One of the railroad cars is visible at right.)

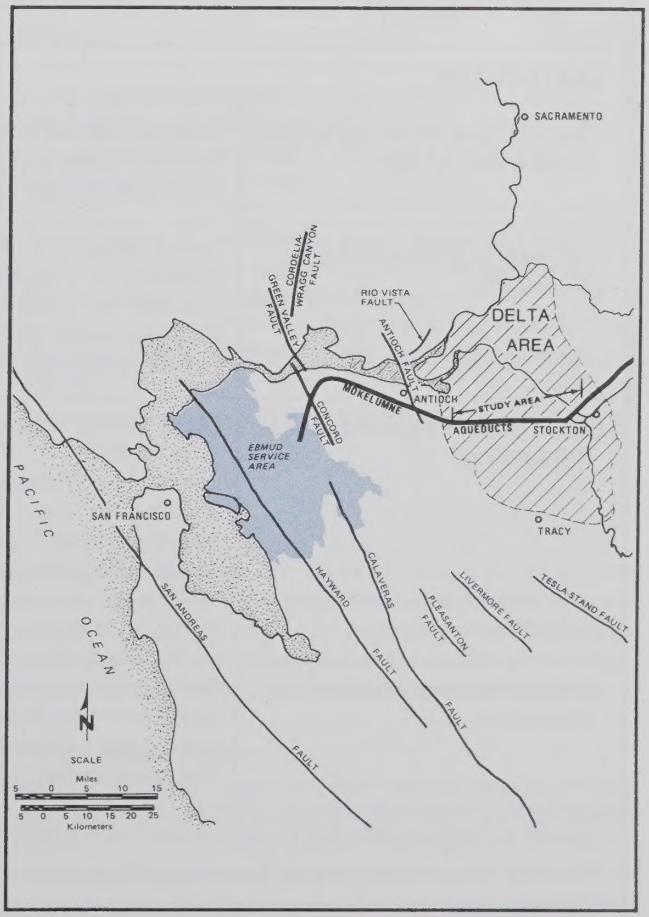
FIGURE 7. HISTORIC DELTA FLOODING



Since the early 1900s, there have been no major earthquakes affecting the Delta. However, during the 1800s, there were several major quakes in the region. It is impossible to predict when and where the next major earthquake will occur or its magnitude, and it can be expected at any time. A maximum earthquake on the nearby Antioch Fault with a very high level of ground shaking in the Delta would be expected to occur only once in every 250 years. On the other hand, a low to moderate level of ground shaking caused by an earthquake on any one of 12 different faults, or a high level of ground shaking caused by an earthquake on the Antioch Fault, are much more likely events, one in 23 years and one in 83 years, respectively.

A primary effect of seismic ground shaking in the Delta is the loss of strength in the water-saturated sandy soils which temporarily liquify ("liquefaction"). This serious condition affects the integrity of levee support soil under and around buried pipelines, underwater river crossings, and piles under the elevated aqueducts. Another seismic effect is failure of the piles and supports under the elevated aqueducts because of inadequate structural strength to resist the earthquake forces. The extent of damage or collapse caused by these effects, which work together, depends on the level of ground shaking resulting from the earthquake. Table 3 lists the types of aqueduct failures, based on data provided by the special consultants listed on Page 2.

FIGURE 8. EARTHQUAKE FAULTS



Potential Outage

Table 3 shows the estimated period of repair time required until delivery of water can be restored. In the event of an extended outage, the limited supply available from the existing terminal reservoirs would have to be severely rationed and other emergency measures would be required. (See Alternatives.) The necessary reduction in demand under various conditions is shown in Table 2. Given the various threats, combined and individual, with greater frequency at lower levels, an outage time of 13 months has been assumed for planning purposes. (Earlier studies suggested up to 33 months.)

Increased protection against extended outages of the Mokelumne supply can be achieved by making improvements to:

- Assure that an adequate high quality supply (no Delta diversion) is available to meet the restricted demand during an extended outage of the Mokelumne supply and
- Establish a planning limit for the severity of rationing during an extended outage.

TABLE 2. DEFICIENCY DURING WATER SUPPLY OUTAGE

Potential Outage	Demand Reduction with Existing Storage (%)	
	1995	2020
10 Months	53	61
13 Months	64	69
17 Months	73	78

TABLE 3. TYPES OF AQUEDUCT FAILURE IN THE DELTA

EVENT	ESTIMATED DAMAGE	OUTAGE**
EARTHQUAKE		
Very high level of ground shaking (greater than 0.25g)*	Extensive levee failure and all islands and tracts flooded. Elevated aqueducts completely collapsed. Extensive damage to all buried pipelines and river crossings.	Up to 17 months
High level of ground shaking (0.2 to 0.25g)*	Levee breaks at many locations and most islands flooded. Elevated No. 1 Aqueduct completely collapsed. Elevated No. 2 and No. 3 aqueducts collapsed at several locations. Breaks in buried pipelines at several locations. Extensive damage to pipelines at one or more river crossings.	Up to 13 months
Low to moderate ground shaking (0.1 to 0.2g)*	Levee breaks at several locations and one or more islands or tracts is flooded. Elevated No. 1 Aqueduct extensively damaged. Elevated No. 2 and No. 3 Aqueducts damaged at a few locations. Possible breaks in buried pipelines. Some damage to pipelines at one or more river crossings.	Up to 10 months
FLOOD		
Single break near elevated aqueducts	Levee break at one or more locations. Scour from flow through levee undermines pile supports. One or more aqueducts opposite the break are damaged. The island or tract is flooded.	Up to 4 months

*Based on technical studies by independent consultants of ground acceleration due to an earthquake.

**Outage means severance of Mokelumne River water supply.

TABLE 4. ALTERNATIVES TO REDUCE SECURITY RISK

ALTERNATIVE	REMARKS
1. **Do Nothing**	Continue risk of extended water system outage due to flooding or earthquake damage to aqueduct pipelines in the Delta, with need for severe water rationing during the outage.
2. **Water Conservation** (Additional Measures)	Continue existing program and implement additional feasible measures which would save a total of 7 MGD by 2020 ($0.6 million per year); this would not provide security against an extended outage.
3. **Water Reclamation** (Additional Projects)	Continue existing program and implement additional feasible projects which would save about 5 MGD by 2020 ($15 million); this would not provide security against an extended outage.
4. **Levee and Foundation Improvements in the Delta**	Continue levee maintenance; upgrade levees; investigate possible levee reinforcement and improvement of pipe supports; and do testing and preliminary engineering for potential future pipeline replacement ($10 million); this would reduce some risks of outage but would not solve the security problem.
5. **New Aqueduct Pipeline Across the Delta**	Pipeline designed to withstand maximum earthquake would provide security against an extended outage ($265 million); field testing of pipeline support designs and studies of levee reinforcement are needed; future implementation of the USBR contract could affect the size of the pipeline.
6. **Water Banking** (Additional Terminal Storage)	Additional storage of 145,000 acre-feet would provide security against a 13-month outage with rationing limited to a 25% reduction of demand during the outage, at a projected demand of 270 MGD in the year 2020 ($152 to $186 million).
7. **Interties with Other Agencies**	No water agency has significant long-term surplus water that EBMUD could depend on for security against an extended outage; increase in capacity of existing connections with San Francisco's Hetch Hetchy system through Hayward should be studied.
8. **Delta Water Use**	Flooding due to levee failure or earthquake would cause salt water intrusion into the Delta with extremely high levels of salinity making the water unusable, with no Mokelumne water for blending.
9. **Groundwater Resources**	Usable groundwater resources within EBMUD are 1 to 2 MGD, which is inadequate for security.

ALTERNATIVES FOR SECURITY OF SUPPLY

The alternatives for improving the security of EBMUD's water supply are listed in Table 4 and are discussed in more detail in this section.

Do Nothing

To do nothing would mean a continuation of the current level of routine maintenance and patrolling of levees, but no substantial improvements. There would be continued deterioration of the conditions in the Delta, which over time would mean increased vulnerability of the aqueducts to an outage that could result in severe water rationing. EBMUD would be unprepared for such an outage, which would make it last longer than necessary.

Water Conservation

EBMUD's water conservation efforts began in the early 1970s and have continued with an increased emphasis in recent years. Rationing in 1977 provided first hand experience with customer reaction to a short term water shortage emergency

and the impacts of water use restrictions. The alternative of expanding EBMUD's water conservation program to keep water demand during normal conditions at a low enough level to survive an extended outage of the Mokelumne supply would have to be based on extreme mandatory measures. Demand is currently about 220 MGD and is projected to increase to 270 MGD in 2020. The existing standby storage in the terminal reservoirs will accommodate a demand of only 81 MGD for 13 months, requiring reductions of 139 MGD today and 189 MGD in 2020.

A permanent reduction of demand to 81 MGD (63 to 70 percent reduction) would require extraordinary changes in water use by residential, industrial, commercial, institutional, and irrigation customers, with significant investment by customers in water saving equipment. There would be major impacts on the economy and lifestyle of the East Bay area. The experience with rationing during 1977 demonstrated what EBMUD customers had to do to achieve only a 39 percent reduction in demand---landscape irrigation was drastically reduced or eliminated, people flushed toilets and used showers less frequently, and non-essential water uses were suspended. Industrial and institutional customers became more efficient in their water use by installing new equipment, repairing leaks, and modifying processes, much of which continues today making further reductions in water use more difficult.

TERMINAL STORAGE: ITS FIVE FUNCTIONS

EBMUD has five terminal reservoirs in the East Bay hills, as shown in the map on the cover of this Summary. Together they provide a net usable storage capacity of 138,000 acre-feet.

Terminal storage has the following functions:

- **Emergency Standby** — storage maintained to meet demand during disruption or outage. It provides a minimum of 120 days of supply at normal demand to be able to cover disruptions while effective demand reduction measures are being implemented. This is the time needed to repair damage to tunnels, pumping plants, and pipelines. The 120-day reserve is maintained in drought conditions and provides a minimum storage carryover to the following year;
- **Regulation** — store Mokelumne River water in the winter and spring, when Sierra runoff occurs and demand is low, for use during the high demand period in the summer months. Both the 120-day standby and regulation storage requirements are independent of the source of supply, and at the current demand of 220 MGD, the storage required is 125,000 acre-feet. (See Figure 14).
- **Drought Reserve** — for meeting supply shortages in dry periods such as 1928-34, 1976-77, and 1987-88.
- **Develop Local Yield** — collect and store storm runoff from the reservoir watersheds. The storage capacity for regulation and local yield is referred to as "operational capacity" as shown in Figure 15 on Page 20.
- **Environmental Preservation and Recreation** — 26,000 acres of watershed land on which these reservoirs are located provide open space and water related recreation on 8,000 acres of water surface. These lands and water constitute a priceless urban refuge permanently protected from development. These watershed lands and the adjacent regional parks include an 80-mile system of trails wandering east of the Oakland-Berkeley Hills. (EBMUD's watershed protection program is described in the Safety section of this Summary.)

Water Reclamation

The reuse of water through water reclamation is an option for non-potable water uses such as irrigation and industrial cooling. Feasible reclamation projects require a large non-potable demand in a limited area, close proximity to a wastewater source, and limited additional treatment requirements. Future reclamation projects could provide some additional savings, but not in the range of the 139 to 189 MGD reduction necessary to be able to survive a 13-month outage of the Mokelumne supply (see water conservation discussion above). When water uses are transferred to reclaimed water as a source, then the burden of demand reduction during an outage has to shift to other customers.

Levee and Foundation Improvements in the Delta

This alternative would involve completion of the minimum improvement work started in 1981, including minor repairs, upgrading, and raising the levees at river crossings and along the alignment of the elevated aqueducts. EBMUD contributed $1.4 million to this reclamation district work through 1987, and its contribution for completing it would be about $2.0 million. This would provide increased security against levee failure due to sloughing, erosion, or over-topping. Additional upgrading of levees could cost $6 million. However, this does not provide physical protection against ground shaking due to an earthquake and the potential for an extended outage of the water supply system.

At the same time, the preliminary engineering for future improvements in the Delta, could be performed:

- Investigation and feasibility studies of improvements such as levee reinforcement and modification of supports under the existing aqueduct pipelines for reducing the risk of aqueduct damage due to flooding and lower earthquakes.
- Field testing and preliminary design of possible pile support systems and a future aqueduct pipeline across the Delta to shorten the response time in the event of a disaster.

New Aqueduct Pipeline

An alternative that could provide secure delivery of the Mokelumne supply would be to construct a new pipeline across or around the Delta. It would be designed to survive the extimated maximum ground shaking from an earthquake and long term inundation if an island is flooded. Part of or the full 325 MGD capacity of the present aqueducts would be provided by one or two pipelines. Full capacity would require two 86-inch pipelines. Studies indicate that the most cost-effective alignment is parallel to the existing aqueducts.

The pile supports under the elevated pipe would be designed to withstand earthquake forces and to accommodate the peaty and liquifiable sandy soils. The pipeline would be designed to resist the effects of scour from the flow through a levee break. The estimated total project cost for a double pipeline is $265 million.

This alternative requires field testing of possible pile support designs and investigation of levee reinforcement at river crossings.

The implementation of the USBR contract for delivery of supplemental water from the Folsom South Canal could affect the size of the pipeline. It may take time to clear the legal obstacles; nevertheless, the high cost of this alternative requires that it have new supply capacity above 325 MGD; therefore, delaying its construction would be desirable.

Water Banking (Additional Terminal Storage)

The five functions of terminal reservoirs are described below. In this alternative, the amount of standby storage would be increased from the present capacity (120 days at full demand) to a level that would provide protection against a potential extended outage of the Mokelumne supply. At the projected demand of 270 MGD in the year 2020, the additional storage required would be:

Limit on Rationing	13-month Outage	17-month Outage
39%	100,000 AF	165,000 AF
25%	145,000 AF	225,000 AF

The 39 percent limit is existing policy; the 25 percent limit would be a change in policy to reduce the severity of rationing as discussed on Page 17. An outage of 13-months has been assumed at a potential frequency of once in 83 years; a longer 17-month outage would occur once in 250 years.

Interties with Other Agencies

Studies by the Association of Bay Area Governments and others have dealt to a limited extent with interties. EBMUD has emergency connections with Hayward's distribution system (5 to 10 MGD) and has proposed doing the same with Martinez and Dublin San Ramon Services District. However, no utility has a significant long-term surplus, and each has long-term commitments and facilities in place that would make it difficult for interties to substitute for the other alternatives presented in this report. In addition, water rights and environmental issues associated with any change in sources or service areas could be significant. Nevertheless, intertie possibilities are included for discussion (See Figure 9):

- San Francisco operates the Hetch Hetchy water system, which runs through the Livermore Valley about 12 miles from the District's distribution system in San Ramon. The lowest-cost approach, which could eliminate the need for construction of expensive treatment facilities, would be to build a 27-mile intertie from the Hetch Hetchy Aqueducts to the Mokelumne Aqueducts in Walnut Creek ($100 million). The Hetch Hetchy supply would be short-term because San Francisco is presently planning an expansion of its system, which is projected to become inadequate by the turn of the century.
- The South Bay Aqueduct of the State Water Project has its capacity contracted for. If an emergency connection were constructed, it would provide Delta water, which is at risk (see discussion at right). Assuming that Delta quality would be maintained, but security would be lost, it would be necessary to construct transmission facilities and a major treatment plant costing about $400 million for the use of any significant quantity of Delta water through the State Water Project.
- Contra Costa Water District has a separate urban (treated water) system and supplies raw water to cities and industries. The system currently has very little storage and under its water rights and contract with the Bureau of Reclamation is limited to the Delta source.
- The smaller water systems around the District, have extremely limited capacity for delivering water to EBMUD. Hayward is supplied by Hetch Hetchy, the Livermore Valley water agencies by the State Water Project's South Bay Aqueduct, Vallejo and Solano County by the North Bay Aqueduct and the Federal Central Valley Project, and Marin County has its own supplies.

Detailed investigation of the advantages and costs of interties is desirable. To date, the interest expressed by other utilities is limited. With high capital cost and limited surplus capacity in systems, it is not expected that there will be a demand for intertie construction.

Delta Water Use

During the 1976-77 drought, EBMUD was concerned about the possible extent of the drought and pumped water from the Delta with potentially adverse effects on the health of its consumers (see Figure 20). During an extended outage resulting from flooding in the Delta, quality could be degraded even further due to salt water intrusion in addition to the continuing inflows of agricultural drainage.

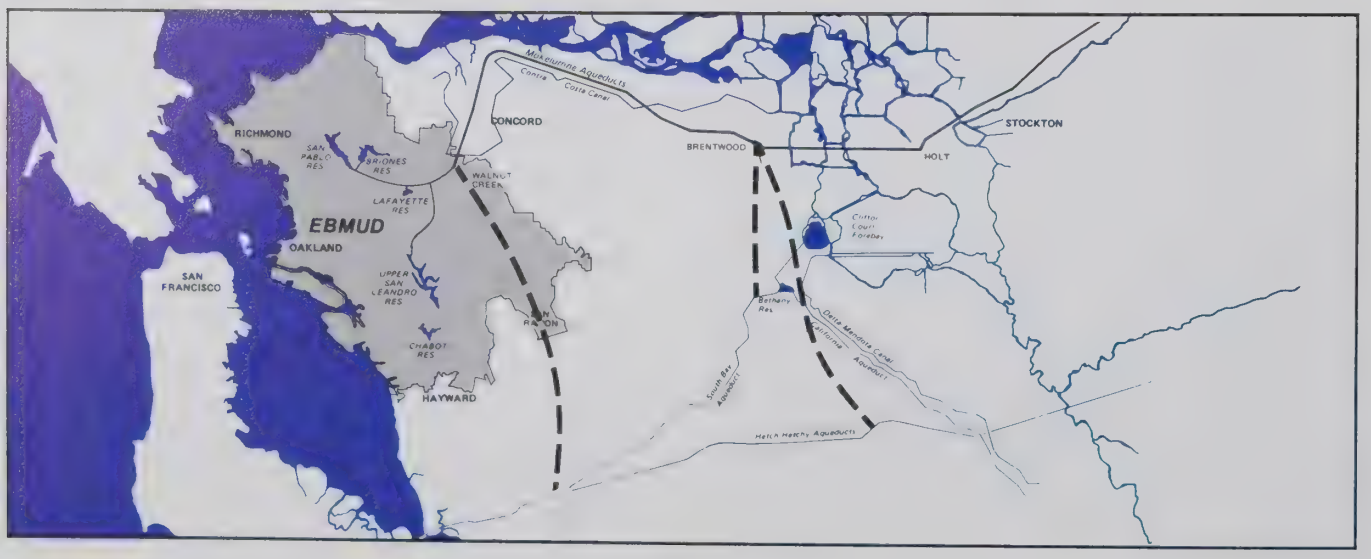
The District's major treatment plants are not equipped to treat Delta water and equipping them to treat it only during emergencies would be expensive. In addition, rapid start-up of an unused treatment plant would result in inconsistent performance.

Since its inception, EBMUD has maintained a policy of diverting no water from the Delta (with the 1977 exception). The District's 1985 Citizens Advisory Committee recommended against such diversions, and state and federal policy urges providing water from the highest source. It would not be desirable to deliver the principal supply to EBMUD users from such a source for 13 months, particularly given the District's present treatment capability.

Groundwater Resources

There are no groundwater resources of appreciable size located within East Bay Municipal Utility District.

FIGURE 9. INTERTIE CONCEPTS



SHORTAGE: SUPPLY TO MEET DRY YEAR DEMANDS

EBMUD operates an extensive water supply system (see data on Table 5). This system has not been augmented since the mid-1960s.

EXISTING CONDITIONS

Precipitation

California is a semi-arid state. Its historic rainfall and tree-ring records indicate great fluctuations in precipitation by area and quantity. The best modern science cannot provide reliable forecasts of precipitation for more than a week in advance. EBMUD's source of supply is the spring runoff from the snowpack in the Mokelumne watershed. Its use by customers is determined by the seasonal rainfall in the Bay Area.

Water Demand

In the past 25 years the number of customers served by EBMUD has increased 20 percent and water use by 30 percent. In 1987, total use reached 220 MGD. The breakdown by categories of customers is shown in Table 6. Residential customers create 62 percent of the total demand.

Water Conservation and Reuse

EBMUD's policies and practices provide for continuing improvement in water use efficiency and reliance on rationing in extremely dry periods. In the early 1970s, EBMUD began a pioneering effort in water conservation education with school programs and materials now used nationwide. This effort has expanded, and today there is a full time staff at the District's Water Conservation Office in Alamo administering a program which includes the measures listed in Table 9.

Reductions in water use by industrial and residential customers, particularly since 1976, have kept today's demand 100 MGD below that projected in the early 1970s. This is due to:

- Reductions in long-term water use by industrial customers as a result of 1977 drought conservation restrictions, water costs, and discharge restrictions.
- Permanent savings by residential users estimated at 5 to 10%.
- Additional recycling projects at EBMUD's wastewater plant and at the Richmond Golf Course.
- Increased District investments in replacing old pipes and leakage control which reduced water losses.

During the 1976-77 drought, users experienced a $75 million loss in landscaping. With presently improved efficiencies, the user impact of a systemwide 39 percent rationing program would be more severe than it was in 1977.

TABLE 5. EBMUD SUPPLY SYSTEM

SOURCES OF SUPPLY
Mokelumne River - 325 MGD
Terminal Reservoirs - up to 10 MGD
Contract with U.S. Bureau of Reclamation - 134 MGD

STORAGE - MOKELUMNE RIVER
Pardee Reservoir - 211,000 acre-feet of storage for water supply and power generation.
Camanche Reservoir - 430,000 acre-feet of storage for stream flow regulation, flood control, senior water rights, and power generation.

DELIVERY SYSTEM
Mokelumne Aqueducts
No.1 65" pipeline (1928)
No.2 67" pipeline (1948)
No.3 87" pipeline (1963)
Gravity flow up to 200 MGD
Pumped flow up to 325 MGD

STORAGE - TERMINAL RESERVOIRS

Briones	(1964)	60,500 acre-feet
Chabot	(1875)	10,300
Lafayette	(1928)	4,200
San Pablo	(1919)	38,600
Upper San Leandro	(1926)	41,400
TOTAL		155,000 acre-feet

WATER TREATMENT PLANTS

Lafayette	(1953)	48 MGD
Orinda	(1935)	175
San Pablo	(1921)	60
Sobrante	(1965)	60
Upper San Leandro	(1927)	83
Walnut Creek	(1967)	80

MGD = Million Gallons per Day

Water Supply Availability Policy

The District has the legal right and capacity to divert up to 325 MGD from the Mokelumne River. Water is available at Pardee Reservoir except during drought periods of two or more years when the supply of water from the Mokelumne, in conjuction with existing storage, would be only 215 MGD, which is the firm yield. This number is declining as water users upstream of Pardee Reservoir with higher priority rights increase their diversions. When demand exceeds the available supply, the District must rely on water from terminal storage reservoirs to help meet demand, and has imposed mandatory rationing when storage was not sufficient to make up for the shortage of supply (1977).

In 1985, the District responded to the increasing risk of shortage by adopting a Water Supply Availability and Deficiency Policy. It anticipates drought cycles and assumes a 25 percent use reduction in the last half of the first year of shortage and a 39 percent reduction of use in the second year ("25/39" reduction). The 39 percent Districtwide use reduction was achieved in 1977, but will be increasingly difficult to achieve due to industrial and residential steadily improving efficiency.

In 1987, in the absence of an apparent drought, the users did not achieve a requested 12 percent reduction despite a $500,000 investment in conservation publicity. However, use did not increase so the program is believed to have had some effect. This experience indicates that a voluntary 25 percent reduction in demand in the last half of the first year of a drought should not be included in the determination of the firm yield of the Mokelumne system.

Users' willingness to conserve depends to some extent on a Bay Area perception of shortage. In 1987, EBMUD's watershed produced less water than the supplies of nearby agencies such as the South Bay. The same appears to be true in 1988. Thus **it may not be possible in a geographically limited drought situation to achieve anywhere near a 39 percent water use reduction.** In addition, the policy's 39 percent reduction should be lower due to the increased efficiency of water use by customers since 1976.

Figure 10 shows that the 39 percent limit on rationing during a drought affects the availability of the supply in normal years for planning purposes. The current planning level is 252 MGD, and will decline to 222 MGD by the year 2020, which is referred to as the "maximum acceptable level of demand." This is based on analyses of operations with Pardee and Camanche Reservoirs, existing terminal reservoirs, historic weather patterns and river runoff, and water diversions by others on the river which increase over the years. The 39 percent limit would be exceeded after demand in normal years reaches about 240 MGD around the year 2000. The District's obligations for downstream releases and fish flow may be increased due to the increasing desires of the Department of Fish and Game and sports fishermen for greater releases of water from the District's storage on the river, which would reduce the supply availability in dry years.

When the acceptable maximum level of demand was first established, it was determined to be 240 MGD, considering only the Mokelumne River diversion. This was endorsed by the Citizens Advisory Committee in 1985. Later estimates developed through more all-inclusive computer analyses of the entire system, including the terminal reservoirs, were 242 MGD in 1990, declining to 225 MGD in 2020. The most recent updated estimate (described above) results from a further development of the demand reduction that would be expected in a repeat of the drought conditions from 1928 to 1935 as well as the 1976-77 drought, based on the Water Supply Availability Policy.

PROJECTED NEEDS

Projected Increase in Demand

Water demand within EBMUD's ultimate boundary is projected to increase from the current 220 MGD

TABLE 6. WATER DEMAND IN 1986

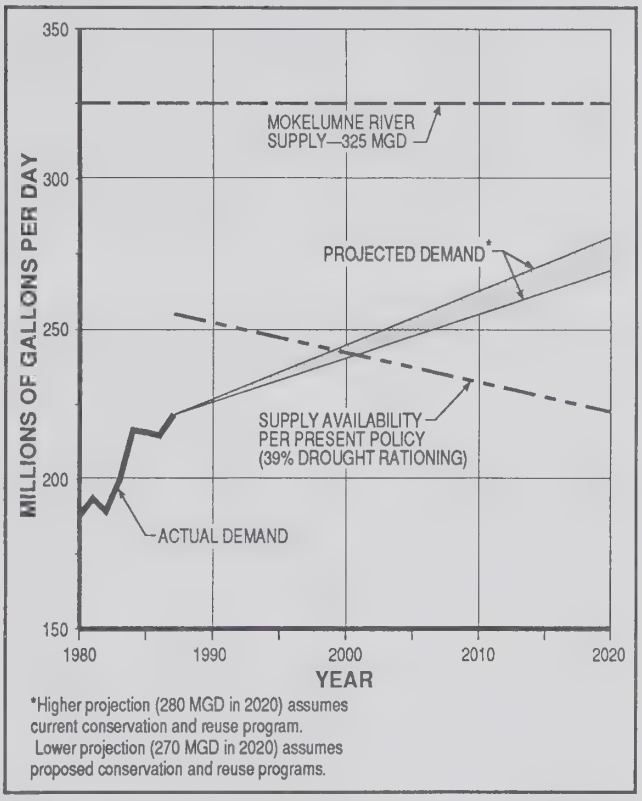
CATEGORY	WATER USE (MGD)			PERCENTAGE OF OVERALL TOTAL
	Indoor	Outdoor	Total	
Residential - Single Family	50	41	91	42
Residential - Multi-Family	23	8	31	14
Commercial and Institutional	25	7	32	15
Industrial - Petroleum	14	1	15	7
Industrial - Other	14	1	15	7
Parks, Golf and Cemeteries	1	11	12	6
Micellaneous Water Use	–	–	2	1
District Water Use	–	–	1	1
Unaccounted for Water	–	–	16	7
		TOTAL	215	100 %

to a level between 251 and 294 MGD by the year 2020. As shown in Figure 10, a projection of 270-280 MGD assumes a mid-range growth rate, with 270 MGD full implementation of EBMUD's current water conservation and reuse programs, which is being used for planning purposes. EBMUD's ultimate boundary defines the planning limits of its future service area at 385 square miles (see map on cover). It includes potential development on annexable private lands of about 3 square miles. Service to areas beyond the ultimate boundary is not included in the projected demand, except for the recently annexed areas east of Danville.

Annexations to EBMUD are under the jurisdiction of the Local Agency Formation Commission (LAFCO) of Alameda County. It has relinquished jurisdiction to LAFCO of Contra Costa County for annexations within that county. Applications to LAFCO may be filed (1) by EBMUD at the request of a property owner, (2) by a city or county, or (3) directly by the property owner. Annexation to a city already served by EBMUD is automatic unless EBMUD objects, which does not involve LAFCO.

Increase in water demand is determined by the residential and commercial development planned and approved by the cities and counties within the District. New construction in existing communities is the predominant factor affecting future demand. Demand has been projected on the basis of population, housing, employment, and land use projections by the Association of Bay Area Governments (ABAG) to the year 2005 for the area within the ultimate boundary. Longer term county projections by the State Department of Finance were used for extension to the year 2020.

FIGURE 10. PROJECTED DEMAND



The demand projection takes into account the differences in geographic, climatic, and land use characteristics across the EBMUD service area, which have a significant bearing on water use. Indicative of the expected growth are the projections of households within EBMUD, as shown in Figures 11 and 12.

FIGURE 11. POPULATION AND HOUSEHOLDS

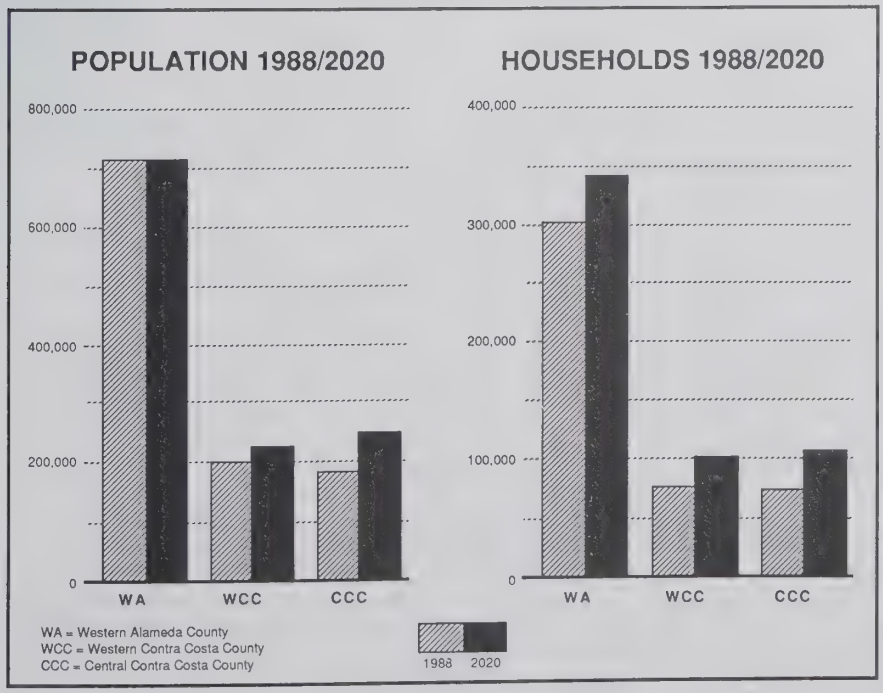
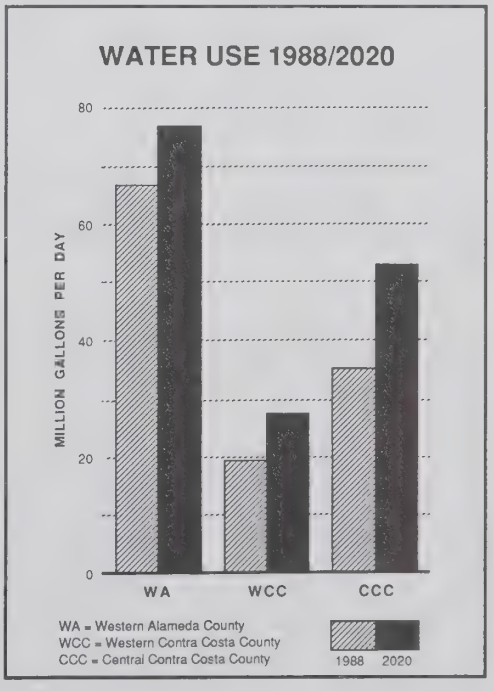


FIGURE 12. RESIDENTIAL USE



Service Obligation

As a utility, EBMUD has an obligation to provide water service to properties located within its boundaries and to annexed territory within its ultimate boundary as the cities and counties plan and permit new development. To accommodate this service obligation, EBMUD must anticipate the future needs of existing customers and assure that the water supply system is adequate for the projected increase in demand.

The projected demand will exceed the supply availability around the year 2000, as shown in Figure 10, based on a 39 percent reduction in demand in a repeat of 1976-77 drought conditions. However, the 39 percent limit may have to be reduced as discussed on Page 17. If the planning criterion is revised to a 25 percent maximum reduction, then the reasonable yield of the Mokelumne supply will be lower and will be exceeded by projected demand in the mid to late 1990s, as shown in Figure 13.

In either case (39% or 25%), as shown in Table 8, the impact on customers will be increasingly significant. Improvements to the system are needed to:

- Improve water use efficiency;
- Reduce the presently planned severity of rationing during drought periods; and
- Increase the supply.

ALTERNATIVES TO REDUCE WATER SHORTAGES

The alternatives are summarized in Table 7 and are discussed in more detail in this section.

Water Conservation

The efficient use of available water resources is an important part of water supply management. The existing water conservation program in effect at EBMUD is shown in Table 9. Water savings of 4

TABLE 7. ALTERNATIVES TO REDUCE WATER SHORTAGES

ALTERNATIVE	REMARKS
1. DO NOTHING	Continue the problem of water shortages during drought periods with increasing severity of rationing required in second dry year as demand increases in the future.
2. WATER CONSERVATION (Additional Measures)	Continue existing program and implement additional feasible measures which would save a total of 7 MGD by 2020 ($0.6 million per year); this would not be sufficient to solve the problem of shortages nor to reduce the severity of rationing.
3. WATER RECLAMATION (Additional Projects)	Continue existing program and implement additional feasible projects which would save about 5 MGD by 2020 ($15 million); this would not be sufficient to solve the problem of shortages nor to reduce the severity of rationing.
4. WATER BANKING (Additional Terminal Storage)	Additional storage of 95,000 acre-feet would provide capability of surviving a drought period with rationing limited to 25% during the second dry year, at a projected demand of 270 MGD in the year 2020 ($115 to $146 million).
5. USBR CONTRACT	Implementation of the USBR contract by connection to the Folsom South Canal would, in conjunction with storage, help reduce the severity of rationing in a drought; implementation is delayed by litigation, therefore this is not an available alternative.
6. INTERTIES WITH OTHER AGENCIES	No water agency has surplus water in a drought that EBMUD could depend on for shortages or reducing the severity of rationing, except those agencies with water supplies from the Delta; if use of Delta water is considered then EBMUD could pump directly from the Delta (see next alternative)
7. DELTA WATER USE	Water from the Delta is adequate in quantity, but its quality is inconsistent with EBMUD's treatment systems (improvements would cost $370 million) and its policy on water quality; water quality in the Delta is at its worst in dry years; experience shows that use of Delta water, even for short periods, should be avoided as a solution for the problem of shortages.
8. EXCHANGE WITH WOODBRIDGE DISTRICTS	Up to 39,000 acre-feet of additional Mokelumne water could be available if the Woodbridge districts were to reduce their Mokelumne diversions in exchange for some other source; one possible source could be the Delta (about $25 million for facilities) or a small amount from groundwater sources in the Woodbridge area; feasibility and institutional arrangements are uncertain; this water could help but would not solve the problem of shortages.

MGD are projected as a result of continuing activities at current levels, with the water savings gradually building from now to the year 2020. Actual savings may differ and the measures themselves may be changed as EBMUD gains more experience with the program and collects data on the water saved.

The alternative water conservation program consists of the existing program plus the additionnal measures shown in Table 9. The additional measures are those found to have the potential for being successful in achieving water savings and are considered to be the most reasonable, feasible, and publically acceptable.

DROUGHT USE WATER LIMITS

The District's supply from the Mokelumne River is 325 MGD. The limit on demand reduction in a repeat of drought conditions affects the availability of the supply for planning purposes. While a 39 percent overall reduction in demand was achieved in 1977, the impact on many District customers was significant. The loss of landscaping alone was estimated at $75 million. In addition, industrial and institutional customers became more efficient in their water use by installing new equipment and devices, repairing leaks, and modifying processes. This increased efficiency, together with more efficient plumbing fixtures in new construction and increased use of low water use landscaping, means that a rationing program today to achieve a 39 percent reduction will cause a much greater hardship than it did in 1977. As water conservation efforts continue to improve water use efficiency, the same reduction will become even more difficult. This is shown in Table 8 as the achievable reduction in drought.

In light of this and also to reduce the severity of rationing to a more reasonable level, the planned maximum reductions for the various categories of customers could be reduced as shown in Table 8, with an overall maximum reduction of 25 percent. Figure 13 shows the effect on the availability of the Mokelumne supply if the limit on rationing is reduced from 39 to 25 percent with no increase in storage capacity.

FIGURE 13. SUPPLY AVAILABILITY

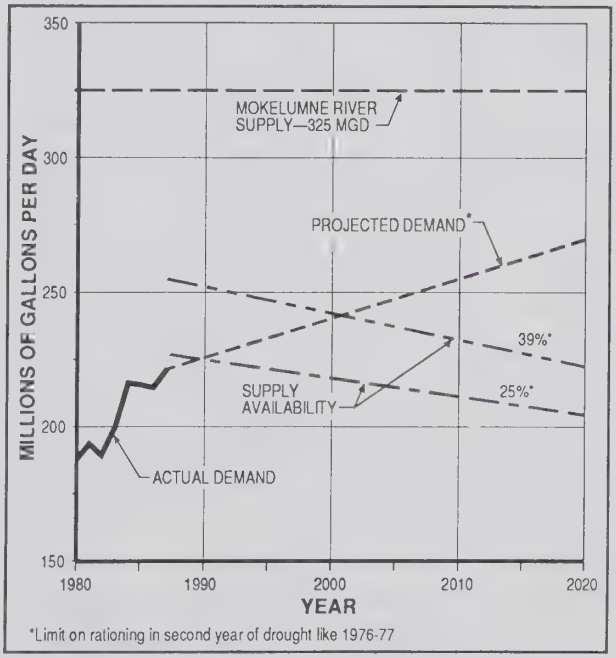


TABLE 8. DEMAND REDUCTION IN DROUGHT

CUSTOMER CATEGORY	ACTUAL DEMAND REDUCTION IN 1977	ACHIEVABLE REDUCTION IN 1988	ACHIEVABLE REDUCTION IN 2020	REDUCED SEVERITY IN DROUGHT
Residential				
— Single family	49%	44%	42%	35%
— Multi-family	23%	23%	20%	15%
Commercial and Institutional	39%	34%	28%	25%
Industrial				
— Petroleum	18%	12%	0%	0%
— Other	29%	9%	5%	5%
Parks, Golf and Cemeteries	55%	47%	35%	30%
OVERALL	39%	35%	31%	25%

Because EBMUD has water available in excess of its needs most of the time, the approach has been to select voluntary measures. Additional savings of about 3 MGD are projected by the year 2020, for a total of 7 MGD.

EBMUD and other entities have studied most if not all of the conceivable water conservation measures. Many of these have either never been used, are difficult to quantify, or can be implemented only through radical changes in use practices. They were not considered to be feasible for the alternative water conservation program, but are listed as potential measures. The role of pricing in water conservation is discussed on p. 21.

The customers' response to the drought crisis shortages of 1976-77 and 1986-87, are discussed in the Drought Water Use Limits section on Page 17. An alternative conservation program is not directly comparable to additional storage or a new source of supply since it is single purpose and reduces dry year flexibility, and would require unusual mandatory measures in normal years. The savings would occur in future years only as new customers are granted service.

The potential conservation measures could be included in the program for pilot testing. As indicated on Table 9, there is much more that EBMUD can do on water conservation. How much depends on future analyses and study, the costs and benefits of each measure, and the impacts of more efficient uses in terms of EBMUD's ability to respond in a drought and the lifestyles of individual residents. Indoor and outdoor use practices of new residents are being changed and can be further changed, but the volume saved will be small. Changing existing plumbing and gardens is expensive, unprecedented, and benefits will occur only in periods of shortage when users will save the same or more without the expense of long-term changes in home conditions.

Water Reclamation and Reuse

Feasible reclamation projects have several features in common: A large non-potable water demand, close proximity to a wastewater source, and limited additional treatment requirements. The current reclamation program saves approximately 4.7 MGD of potable water, as shown in Table 10.

Projects in Alternate 3 can replace 5 MGD of the existing supply. As more reclamation projects are implemented, particularly for large water users like a golf course or oil refinery, the potable water supply increases. In the event of a drought, reclaimed water users benefit because they are not faced with the consequences of a water shortage. But there is also a negative effect. During a drought, significant reductions in irrigation water use contribute to the overall achievable reduction in demand. When those uses are supplied by reclaimed water, then the burden of demand reduction has to shift to other customers.

TABLE 9. WATER CONSERVATION

EXISTING PROGRAM 30 - YEAR SAVINGS		ALTERNATIVE 2 ADDITIONAL MEASURES		THEORETICAL MEASURES**	
Measure	**Water Savings***	**Measure**	**Water Savings***	**Measure**	**Water Savings***
Leak Detection and Pipeline Rehabilitation	--	Expansion of Water Device Distribution	0.9	Landscape Rebate	1.3
Water Metering	--	Water Audits for Industrial Processes	1.1	Advanced Plumbing Code	2.1
Water Saving Device Distribution	1.9	Expand Landscape Consultations	0.2	Mandatory Toilet Replacement for Residential Customers	12.8
Water Audits	0.9	Irrigation Management of Large Landscaped Areas	0.7	Mandatory Toilet Retrofit for Non-Residential Customers	0.5
Landscape Consultations	0.1	Additional Demonstration Gardens	--	Water Efficient Technology	0.7
Landscape Water Use Efficiency in New Developments	1.1	Landscape Rebate Pilot Program	--	Potential Additional Savings	17.4
Demonstration Gardens	--	Irrigation Upgrade Pilot Study	--		
Public Information and School Education	--	Additional Savings	2.9		
Total Savings	4.0				

*Projected additional water savings (in MGD) by the year 2020

**These measures may have the potential for additional water savings but they are costly, have unproven records and/or impose mandatory restrictions.

TABLE 10. WATER RECLAMATION

EXISTING PROGRAM	ADDITIONAL PROJECTS (Alternative 3)
EBMUD Special District 1 wastewater treatment plant -- landscape irrigation, general washdown, and industrial cooling (2.0 to 2.5 MGD) EBMUD Filter Plants (water treatment) -- reclamation of filter backwash water (2.0 MGD) Richmond Golf Course -- irrigation water from West Contra Costa County Sanitary District treatment plant (0.16 MGD)	Galbraith Golf Course -- irrigation water from San Leandro wastewater treatment plant, to start in summer 1988 (0.15 MGD) Chevron Oil Refinery, Richmond -- cooling water from West Contra Costa Sanitary District treatment plant; pilot study completed; estimated startup in 1991 (potential 4.7 MGD) San Ramon Valley -- irrigation water from Dublin San Ramon Services District treatment plant; planning study (potential 1.4 MGD)

Water Banking

The water supply functions of terminal storage are described on page 10. Water banking made available by the construction of additional terminal storage would limit the severity of rationing during drought periods by increasing the supply.

The ability to meet demand during the second year of a drought period is based on a balance between the amount of water available from the Mokelumne River, the extent to which demand is reduced by a rationing program, and the amount of terminal storage available in addition to the basic 120-day standby. As shown in Figure 14, storage under the 120-day criteria is adequate today. However, additional storage will be needed to stay within drought rationing limits in the future. At the projected demand of 270 MGD in 2020, an additional 55,000 acre-feet of storage are needed to stay within a 39 percent limit and 95,000 acre-feet are needed to stay within a 25 percent limit. Beyond 2020 (about 25 years after a project could be in service), then the storage need will be greater.

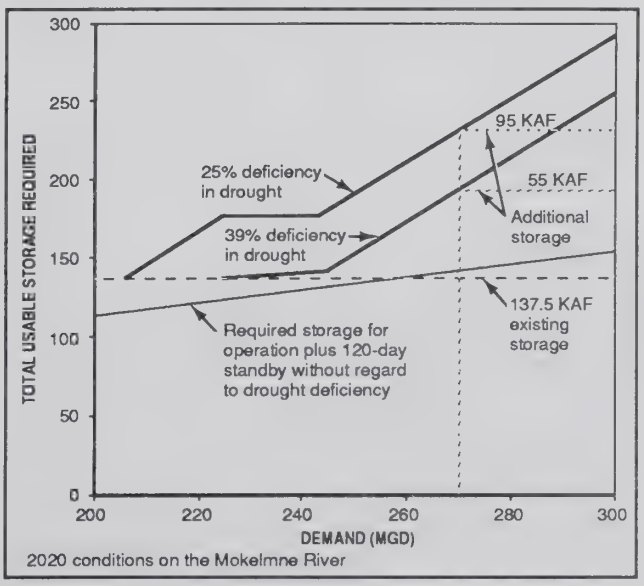
As in the case of many other California Central Valley rivers, offstream storage which "banks" wet season flows can provide for enhanced flows in the lower Mokelumne River to meet downstream obligations to prior water right holders and fish flows that are prescribed in the District's water rights permits and numerous agreements with other Mokelumne interests, including the California Department of Fish and Game. The Department of Fish and Game and fishermen's organizations have complained that these commitments are being violated; the Department is conducting a comprehensive fishery study of the lower Mokelumne River, which is likely to result in recommendations for modified releases from Camanche.

While EBMUD's obligation to deliver high quality drinking water is its first priority, the District makes releases from Camanche to meet its downstream obligations on the river. The District uses these required releases to generate hydroelectric power. They also provide significant flows for fish above the District's obligation. The greater the amount of storage within the District's system, the greater the flexibility that the District will have to conduct its operations on the Mokelumne for the benefit of instream uses, such as fish enhancement. The releases also benefit groundwater pumpers whose wells are recharged with the excess flows in the river.

American River Water

The use of water under the District's 1970 contract with the U. S. Bureau of Reclamation for 134 MGD would increase the supply in normal years and could help reduce the severity of rationing in a drought. In the current litigation over the contract, EBMUD has proposed to avoid taking delivery of water when minimum flow standards are not met in dry years in the lower American River. This could result in EBMUD not taking delivery during a drought year like 1977. To deliver

FIGURE 14. TERMINAL STORAGE NEEDED TO MEET WATER DEMAND



2020 conditions on the Mokelmne River

the water, facilities would have to be constructed from the Folsom South Canal to the Mokelumne Aqueducts. Implementation is currently delayed by the litigation and not considered an alternative at this time. The use of this supply will require the storage discussed in the Security section.

Interties with Other Agencies

The potential for interties with adjacent and nearby water suply systems of other agencies is discussed earlier in the Security section.

An intertie with San Francisco's Hetch Hetchy system would have no benefit in times of shortage during a drought when San Francisco also has deficiencies.

The Contra Costa Water District has a sufficient quantity of Delta water available under its USBR contract to provide some water to EBMUD in the event of a dry year shortage, but its quality is inconsistent with the treatment systems at EBMUD's major filter plants and its water quality policy. In the late fall of dry years Delta water quality is at its lowest---the extraordinary high chlorides can be in excess of 250 milligrams per liter and there are very high levels of bromides and organic contaminants from agricultural runoff.

The State Water Project pumps water from the southern Delta to Bethany Reservoir for the California Aqueduct and for the South Bay Aqueduct extending to southern Alameda County and Santa Clara County. As with the Hetch Hetchy source, a major transmission pipeline would be needed for a connection, and the quality of Delta water is inconsistent with EBMUD's treatment systems and water quality policy.

Delta Diversion

Water from the Delta is adequate in quantity, but its quality is inconsistent with EBMUD's treatment system and water quality policy. It is of significantly lower quality than the Mokelumne River, and there is a concern about future public health risks associated with contaminants. The water quality in the Delta is at its worst during dry

FIGURE 16. WOODBRIDGE EXCHANGE

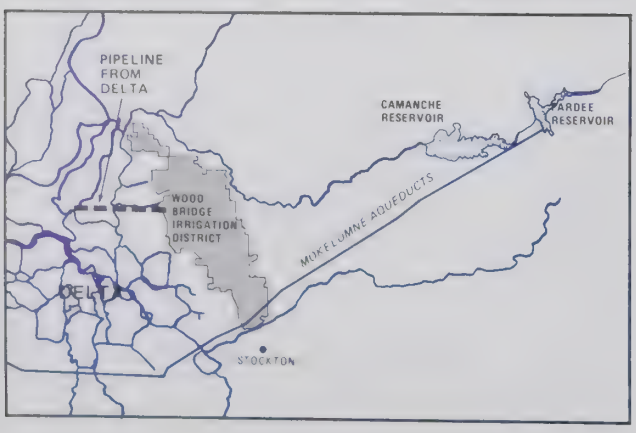
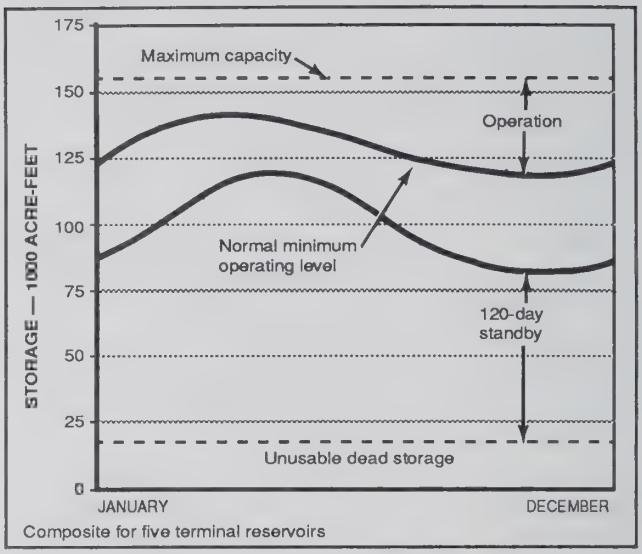


FIGURE 15. CURRENT USE OF TERMINAL STORAGE



periods when EBMUD's Mokelumne River supply is reduced. Furthermore, EBMUD's water treatment facilities and processes are based on using a high quality source of water and would require extensive capital improvements to treat Delta water ($370 million). Even then, although safe, the treated water would be of lower quality. EBMUD used 25,000 acre-feet of Delta water during the last five months of the 1976-77 drought and experienced adverse effects. (See Experiences with Delta Water on Page 22.)

Woodbridge Exchange

Under EBMUD's agreements with the Woodbridge Irrigation District and the Woodbridge Water Users Conservation District, which recognize the relative rights to Mokelumne River water, EBMUD releases enough water from Camanche Reservoir so that a permanent supply of 29,000 to 60,000 acre feet per year (depending on inflow to EBMUD's reservoirs) is available for use by the Woodbridge districts, with additional releases until 1992 for an additional interim supply of 26,855 to 56,700 acre-feet per year. In the Woodbridge exchange concept, EBMUD would enter into an agreement to provide a water supply to those districts from the eastern Delta in dry years in exchange for a reduction in their use of Mokelumne River water. This could increase the amount of water available to EBMUD in those dry years. Approval of the State Water Resources Control Board would be required. However, this does not appear to be a feasible alternative because the resulting decrease in river flows below Camanche Reservoir would be a significant concern to the fish and wildlife agencies and would have an adverse impact on the groundwater basin. Furthermore, there would be no real benefit to the Woodbridge districts and they would have to accept lower quality Delta water.

THE ROLE OF PRICING AND RATES IN WATER MANAGEMENT

Over the past seven years, EBMUD staff and consultant reports on rates and charges have investigated the following:

- The effect of the price of water on water conservation.
- The allocation of costs between new users and existing users.
- The assessment of higher operating costs to areas in higher elevations of EBMUD's service area.
- The provision of assistance to low-income users.
- The cost justification for all rates and charges.

EBMUD is required by law to charge no more than the actual cost of providing service. In recent years, EBMUD capital program has been funded by long-term debt which in turn is largely paid for by charges paid by applicants for service to new development. These charges now range as high as $5,000 per single family home and would reach $8,000 if projects discussed in this report are constructed in newly developing areas while the similar charges in the developed areas would be a third of that amount. The result is each new user to the District's system reduces the cost to the existing ratepayer, by paying water rates and a connection charge.

EBMUD has studied the impact of the recent 50 percent increase in charges for water to higher elevations on the amount of water those customers have used. Detailed analysis indicates no significant reduction in water use despite this large increase contrary to popular perception. (See Figure 18.) Other utilities have had similar experiences. The general low level of water rates compared to other public services does not put water charges in an effective price-demand relationship.

The 1977 experience with water rationing and severe financial penalties, however, indicates that when coupled with a true emergency, a severe price penalty for excessive use can be effective. Small changes in water rates with average bills running between $10 and $20 per month will in most instances not impact a user's water use pattern. Public policy, education on efficient use, incentives and a gradual shift in the approach to landscaping will in time have more impact on water use than rates except in industrial and commercial applications where there is a direct relationship between the water used and the cost of the product. Even so it is a relatively small part of most industries' operating costs. Also there is a price-use relationship with agricultural water deliveries, but the District has no such customers.

FIGURE 17. TYPICAL ANNUAL COST OF WATER SERVICE

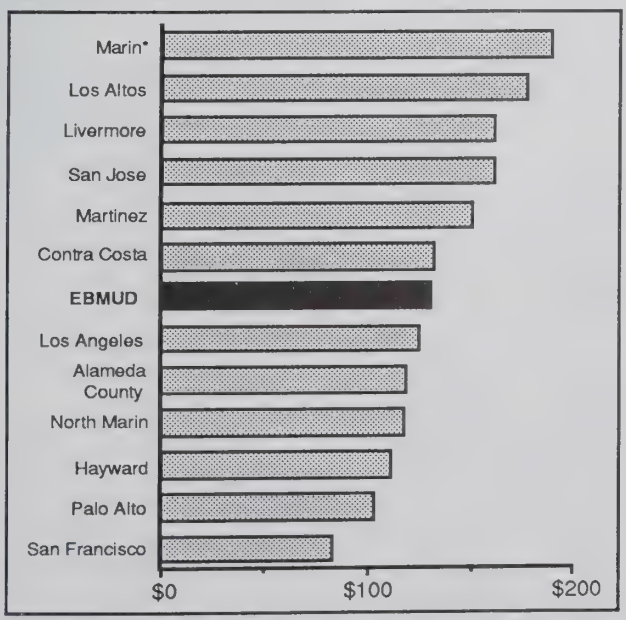
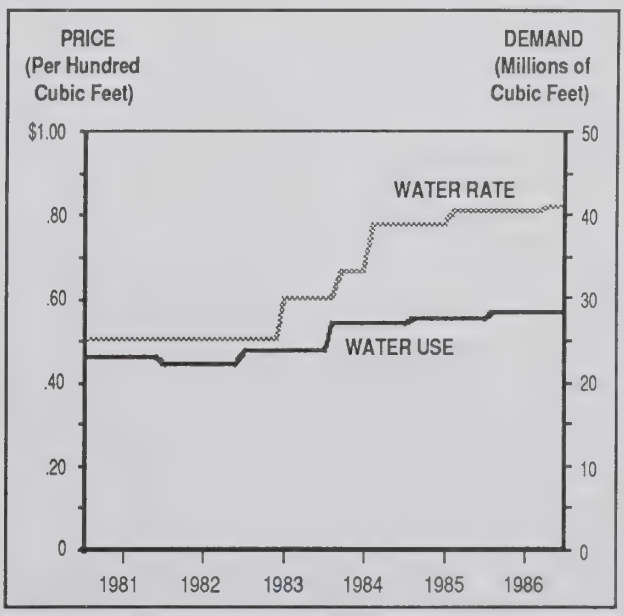


FIGURE 18. PRICE vs. DEMAND IN ELEVATED ZONES



SAFETY AND HEALTH: HIGHEST WATER QUALITY

COMMITMENT TO THE CLEANEST AND SAFEST SUPPLY

In the 1920s, when Pardee Reservoir was constructed on the Mokelumne River, the primary reason for developing a Sierra supply (as opposed to other sources closer to the Bay Area) was the high quality of that source. Today there is even greater reason for using high quality water from the Mokelumne. Increasing regulatory requirements in the 1980s, together with the growing availability of health effects information, make it clear that, to provide customers with high quality water, it is necessary to start with the best available source and to treat that supply with the best available treatment.

Changes in drinking water standards will present some very difficult challenges in the next several years. For this reason, maintaining the best available source of supply is an important part of water supply management. The California Department of Health Services (DOHS) has reiterated its long standing policy that:

> "Water utilities should seek to obtain the cleanest water source practical and provide all reasonable protection of the supply from any known or potential source of contamination hazard."

EBMUD has six filter plants that treat all the water delivered to its customers. (See Table 5.) With the high quality source, the filter plants produce high quality water that is well above current drinking water standards as shown in Figure 19.

ISSUES AND CONCERNS

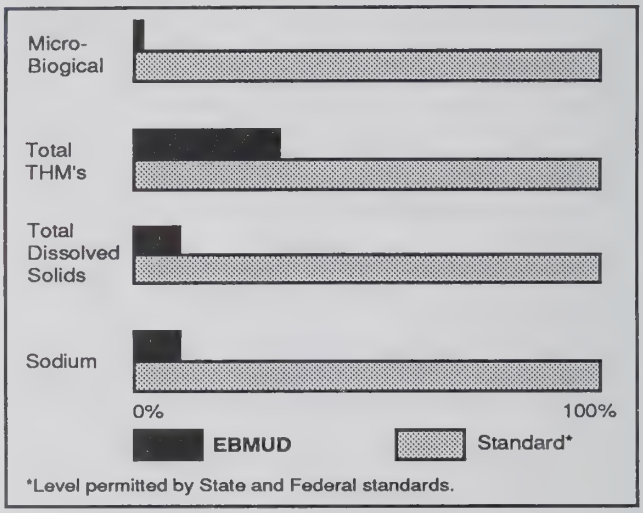
Watershed Protection

The 577-square mile Mokelumne River watershed above Pardee Reservoir is predominantly national forest land and almost entirely undeveloped. In the East Bay hills, EBMUD and East Bay Regional Park District own most of the land tributary to the five terminal reservoirs, but the cities of Orinda and Moraga are also within two watersheds. EBMUD protects the quality of its supply by monitoring and where possible controlling activities within the watersheds that could lead to contamination.

Federal Standards

The 1986 amendments to the federal Safe Drinking Water Act will have a major impact. The Environmental Protection Agency (EPA) is now preparing new regulations to implement the amendments, which will place emphasis on reduction of organic chemicals in drinking water. Even meeting today's water quality standards cannot assure that public health requirements will be met in the future. The best strategy is not to just meet standards, but to minimize contaminants.

FIGURE 19. EBMUD WATER QUALITY COMPARED TO EPA STANDARDS



Trihalomethanes

The most significant known health risk in treated surface supplies is caused by trihalomethanes (THMs). These are suspected cancer-causing compounds resulting from the disinfection of water with chlorine, which reacts with naturally occurring organic compounds to form THMs. The standard for THMs is currently 100 micrograms per liter (ug/L), but there is serious consideration within EPA to lower it to 20 ug/l. EBMUD's THMs are now about 25 ug/l. The THM formation potential is four times higher in the Delta than the Mokelumne.

Taste and Odor

Water delivered through EBMUD's main filter plants in Orinda, Lafayette and Walnut Creek is the very highest esthetic quality. Although there are occasional episodes of chloronous tastes, these have been minimized. However water delivered through Sobrante, San Pablo and Upper San Leandro filter plants from the lower terminal reservoirs is subject to the summertime problem of algae growth causing taste and odor. These filter plants are being upgraded with the latest technology to minimize if not eliminate the taste and odor problems.

Experience with Delta Water

During the 1976-77 drought, EBMUD used Delta water mixed with existing supplies. Significant taste and odor problems were experienced in San Pablo and Upper San Leandro Reservoir water. THMs presented the most serious known health concern, and Figure 20 illustrates the influence on Upper San Leandro Reservoir. A high proportion of

the THMs were caused by elevated levels of bromide in Delta water caused by sea water intrusion. Brominated THMs have been confirmed recently to be more potent as carcinogens.

NEEDED IMPROVEMENTS

Watershed Management and Improvement

EBMUD owns 26,000 thousand acres of watershed land in the Bay Area. Of this, 8,000 acres is water surface. In addition, the East Bay Regional Park District and other public agencies own 20,000 thousand acres of continuous open space. This is a permanent public asset which involves 80 miles of interconnected trails. Extensive treatment is provided though for the water from San Pablo and Upper San Leandro Reservoirs which contain drainage from the Cities of Orinda and Moraga. The Briones Reservoir watershed is almost entirely in public ownership and the alternative terminal reservoir projects can be largely protected by public ownership. Watershed management is essential to providing high quality water to prevent sewage or pollutants from entering reservoirs. This is threatened whenever development is proposed on adjacent watershed lands.

Watershed management would be improved by EBMUD's purchase of watershed lands currently in other ownership and which may have a potential for development. Acquisition of the land to the ridgelines around the terminal reservoirs to the extent possible would help assure that the high quality of stored water can be maintained into the future. The San Pablo and Briones watersheds could benefit by acquisition of a total of 972 acres at an estimated cost of $6.7 million. The Upper San Leandro watershed could benefit by acquisition of 498 acres at a cost of $3.0 million plus the acquisition of the Buckhorn Reservoir watershed. The watershed protection around the Buckhorn Reservoir site could be entirely owned with the purchase of approximately 678 acres at an estimated cost of $2.5 million. The watershed around the Pinole Reservoir site would involve purchase of 24 parcels totaling 2,687 acres at an estimated cost of $16.1 million.

These acquisitions would also minimize ridgeline development in the Moraga/Orinda area and provide opportunities for significant trail enhancement.

Treatment Improvements

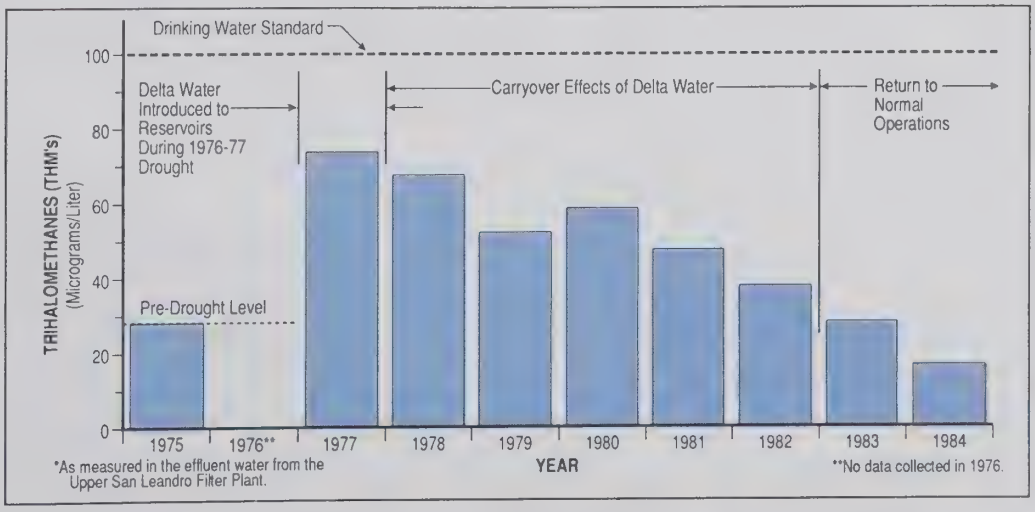
Although EBMUD treated water is superior to state and federal standards, EBMUD continues to pursue advanced water treatment technology. Approximately $35 million in treatment plant improvements are in process or planned to meet these objectives.

A proposed EPA rule on surface water treatment would require significant changes to EBMUD's water treatment processes, requiring the use of ozone instead of chlorine as the principal disinfectant. Pilot testing and preliminary design of ozone facilities will start in 1988, which will determine the cost of retrofitting the filter plants.

Studies

An extensive alternative treatment technologies evaluation is underway at EBMUD, designed to decrease chemical use while producing a higher quality product. One technology being considered is membrane filtration, which is thought to remove turbidity, bacteria, Giardia, and other particulates without the addition of coagulants. Reducing the use of chemicals is consistent with EBMUD's objective of keeping to a minimum the amount of chemicals introduced into the water treatment process.

FIGURE 20. IMPACT OF DELTA WATER ON TERMINAL RESERVOIRS



When Delta water was added to the EBMUD system during the drought, THM levels doubled. It took six years for the THM levels to be flushed out.

THE BENEFITS OF WATER BANKING

Meeting the District's problems of security, shortage, and safety and health requires a composite program of efficient use and reuse, careful planning for dry-year restrictions, Delta improvements, future water supply enlargements, and storage or water banking. The technical report that supports this summary contains details of Delta improvement alternatives. Because terminal storage provides water banking to achieve multiple objectives of security and shortage reduction, the following special analysis was prepared:

In the discussions of Security and Shortage it was shown that additional terminal storage:

- Will protect the water suipply against an extended outage of the aqueduct pipelines in the Delta.
- Will reduce dry year and drought impacts in the future by increasing the availability of the supply as shown in Figure 21.
- When combined with increased efficiency of water use, experienced and planned, can reduce the required rationing from 39 percent to 25 percent, to significantly reduce the severity.

FIGURE 21. STORAGE RESULTS IN INCREASED SUPPLY

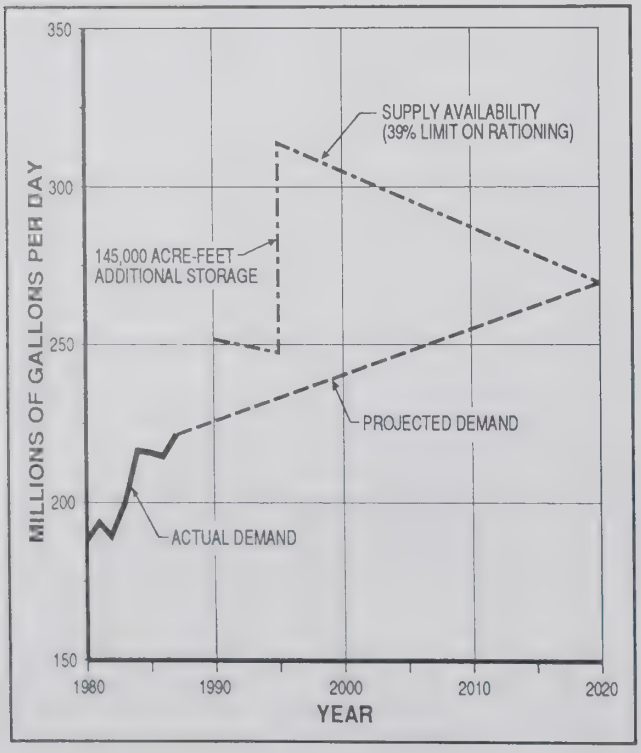
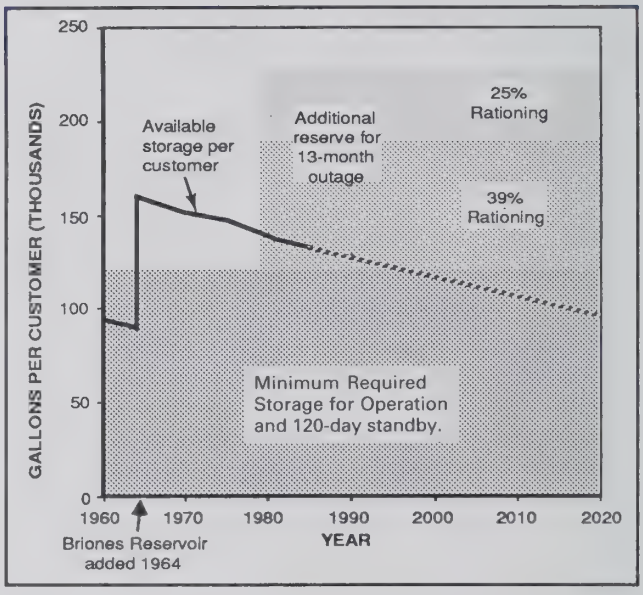


FIGURE 22. STORAGE AVAILABILITY



Terminal storage is a multi-purpose solution to EBMUD's water management needs. Figure 22 shows the storage needs per customer and how that has changed over the years.

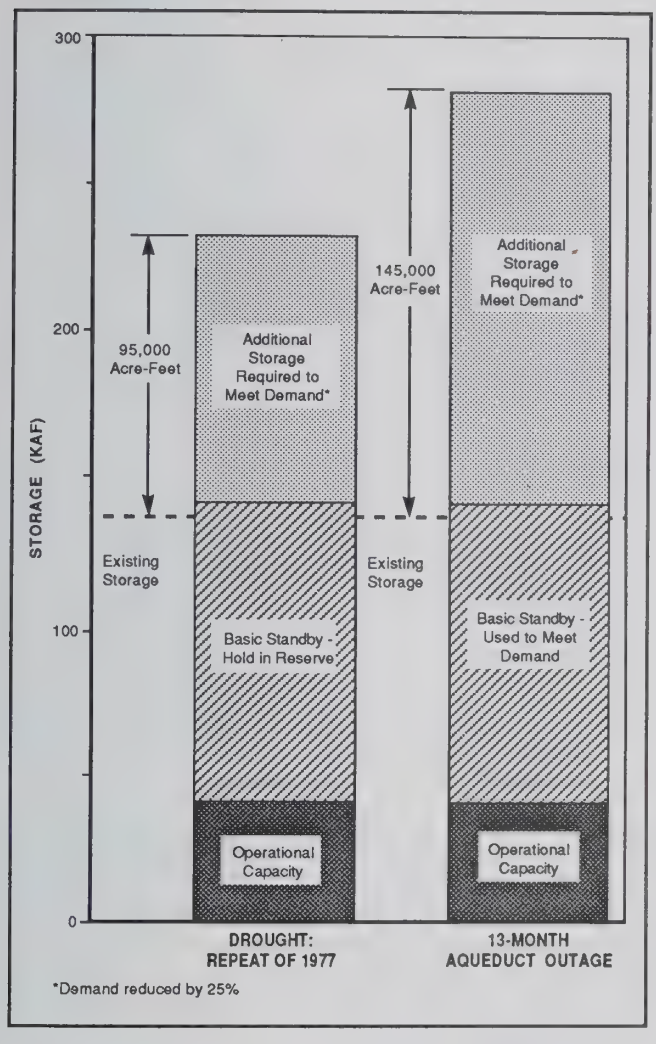
The storage required at a future demand of 270 MGD (projected for 2020) is shown in Figure 23. Surviving a drought like 1976-77 and surviving a 13-month outage of the Mokelumne supply are shown as separate considerations. The storage capacity needed for the combined conditions of a major earthquake affecting the Delta and a worst case drought is shown in Table 11. However, the risk of them occurring in immediate sequence to produce the greater need for storage is very small. EBMUD's storage is based on the greater storage requirement of either security or drought.

The additional storage would then be 100,000 acre-feet at a 39 percent limit on rationing and 145,000 acre-feet at a 25 percent limit.

TABLE 11. ADDITIONAL STORAGE REQUIRED

LIMIT ON RATIONING	SECURITY: 13 - MONTH OUTAGE	SHORTAGE: DROUGHT LIKE 1976-77	COMBINED EVENTS
39%	100,000 AF	55,000 AF	150,000 AF
25%	145,000 AF	95,000 AF	235,000 AF
Based on 268 MGD Demand in 2020.			

FIGURE 23. STORAGE REQUIRED IN 2020



Alternative Reservoir Sites

A total of 26 potential reservoir sites were identified within and near EBMUD's service area. These were evaluated from the standpoints of available capacity (at least 30,000 acre-feet), comparative cost, and land use considerations (displacement of housing and/or disruption of transportation or public use facilities). Four alternative sites emerged from this review for further evaluation: Pinole, Buckhorn, and Los Vaqueros. The possible capacities ranged from 45,000 to 145,000 acre-feet, the initial rough estimates of cost ranged from $1.1 to 1.7 million per 1000 acre-feet, and EBMUD and CCWD own the respective sites. EBMUD also owns all but 10 percent of the Buckhorn watershed. Los Vaqueros Reservoir is a project being pursued by Contra Costa Water District (CCWD) and a joint project with CCWD was assumed.

Table 12 describes the technical features of the three sites, including advantages and disadvantages. The environmental effects are summarized on pages 27 and 28.

Pinole Reservoir would not have sufficient capacity to meet the need for additional storage. Also, it is not situated at a location in the District deliver water by gravity to all of the District's filter plants. Los Vaqueros Reservoir would have sufficient capacity and could supply all filter plants by gravity, but it would require participation in a joint project with Contra Costa Water District and a supply of Sierra water for CCWD's needs as well. Buckhorn Reservoir would also have sufficient capacity and could supply all filter plants. It is also the lowest cost alternative, and EBMUD owns the reservoir site and 90 percent of watershed.

FIGURE 24. ALTERNATIVE RESERVOIR SITES

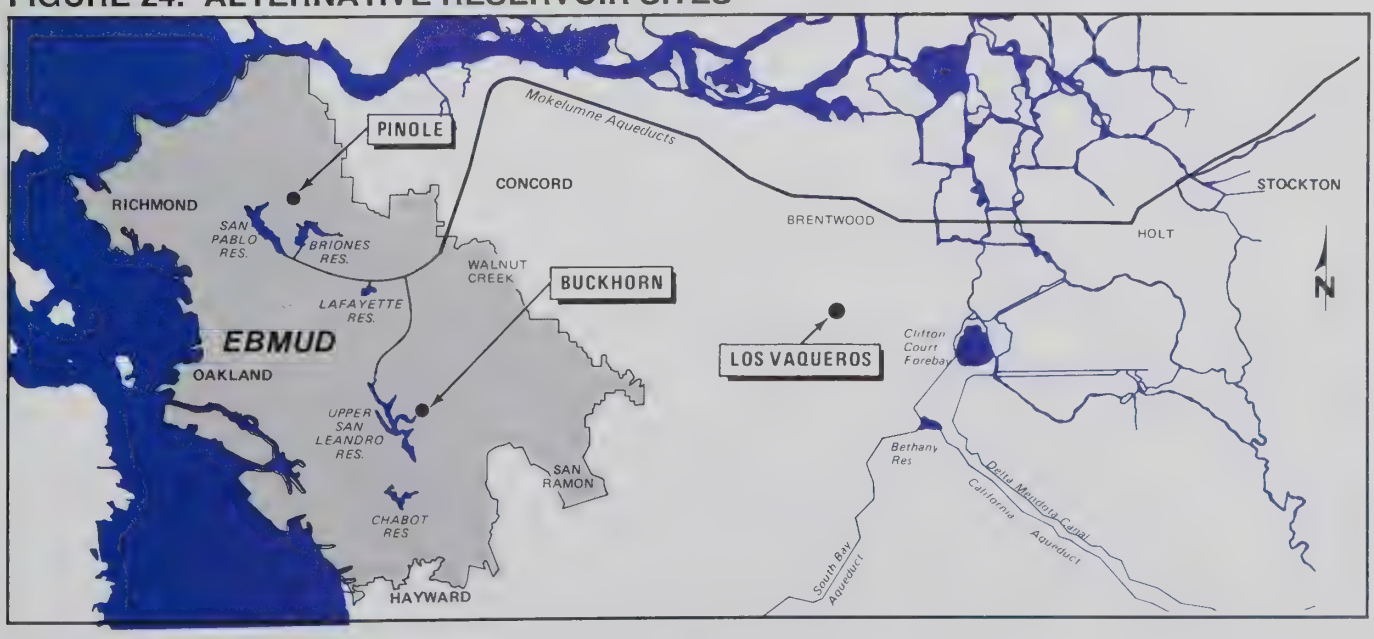
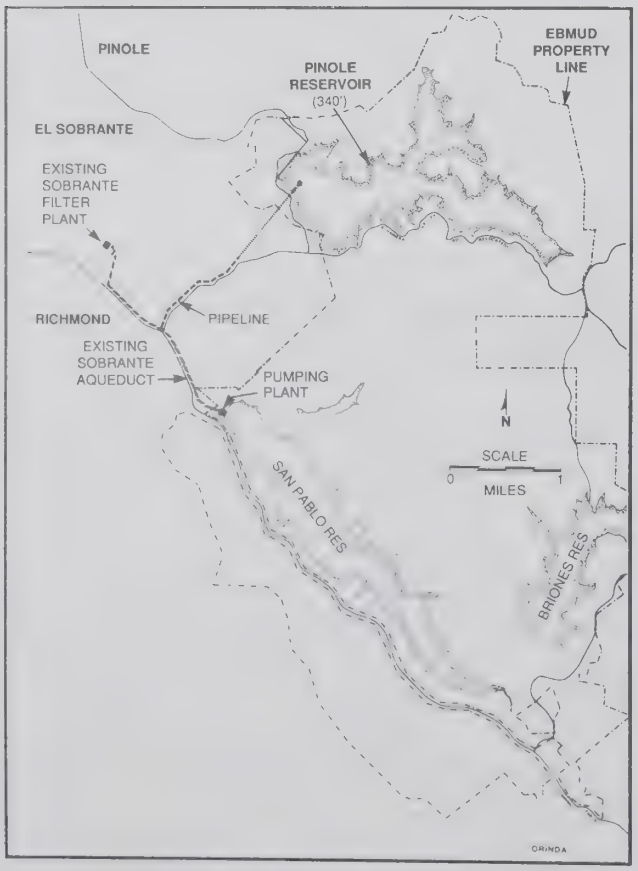


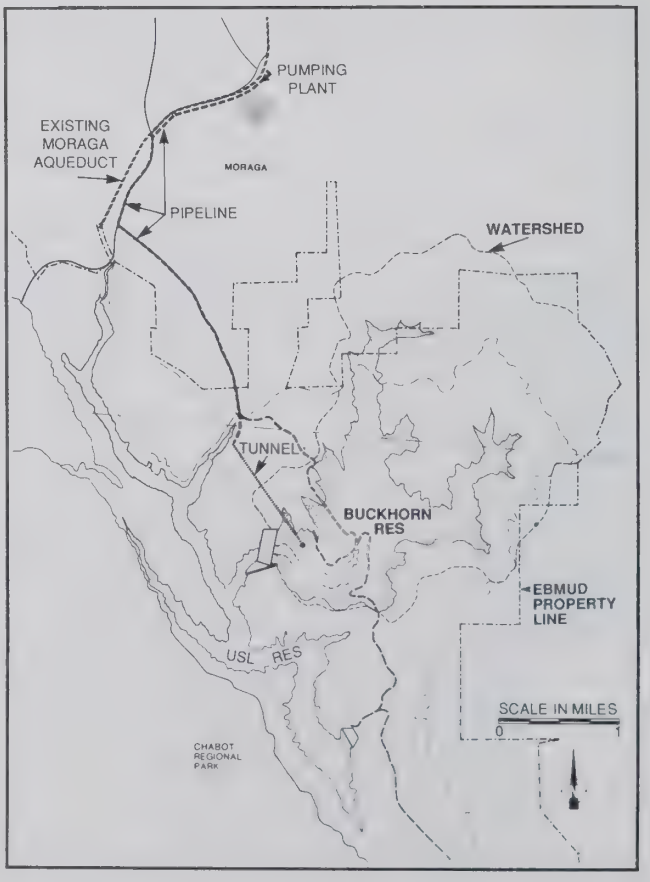
TABLE 12. TERMINAL STORAGE ALTERNATIVES

ALTERNATIVE	ELEMENTS	COST	ADVANTAGES	DISADVANTAGES
PINOLE RESERVOIR 50,000 AF (44,000 AF usable) Spillway elevation 340'	Dam, 180' high. Pumping Plant at San Pablo Dam. Pipeline in right of way and Castro Ranch Road. Inlet-Outlet Tunnel	$60 Million	• Reservoir site owned by EBMUD • Convenient access for construction.	• Capacity not adequate for supply, security and shortage. • Gravity supply limited to two filter plants. • Significant part of watershed in private ownership (48%). • Lower water quality.
BUCKHORN RESERVOIR 145,000 AF (143,000 AF usable) Spillway elevation 745'	Dam, 370' high. Pumping Plant near St. Mary's College. Pipeline in Camino Pablo and St. Mary's Road. Inlet-Outlet Tunnel.	$152 Million	• Adequate capacity for security and shortage. • Gravity supply to any filter plant. • Completely protected from urban development. • Most of reservoir site owned by EBMUD. • Highest water quality.	• Less convenient access for construction.
LOS VAQUEROS RESERVOIR 155,000 AF for EBMUD (144,000 AF useable) 265,000 AF Total 560'	Dam, 265' high. Pumping Plant near Mokelumne Aqueducts. Pipeline connection to Mokelumne Aqued. Inlet-Outlet Tunnel	$186 Million	• Adequate capacity for identified need. • Gravity supply to aqueducts.	• Joint project with CCWD; requires joint agreement and supply of Sierra water for CCWD's needs as well. • Site not owned by EBMUD (CCWD beginning to purchase it). • Distant from EBMUD

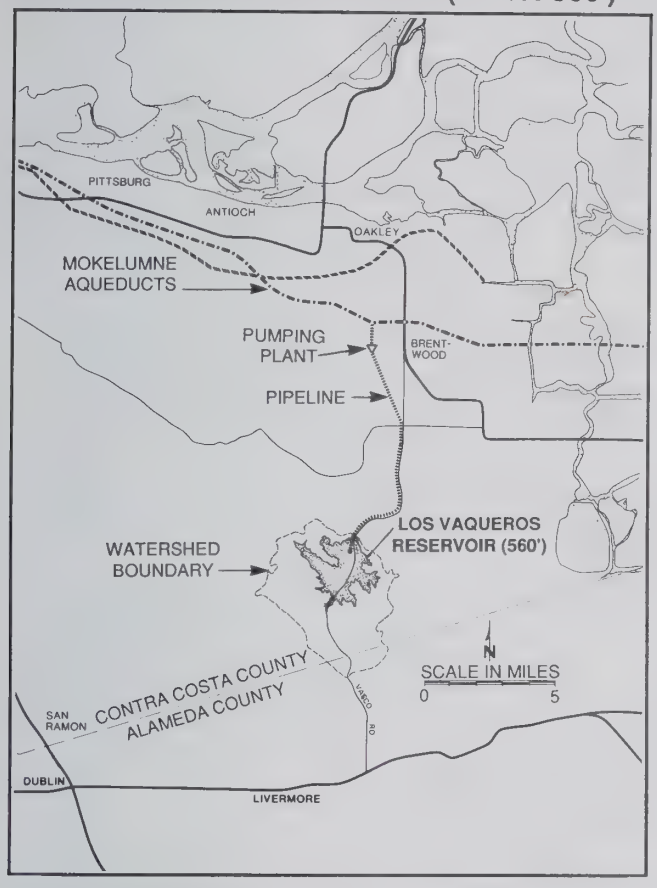
PINOLE RESERVOIR (ELEV. 340')



BUCKHORN RESERVOIR (ELEV. 745')



LOS VAQUEROS RESERVOIR (ELEV. 560')



PINOLE RESERVOIR		
POTENTIAL ENVIRONMENTAL EFFECTS		MITIGATION
• Land Use	800 acres of cattle grazing land converted to body of water	Acquire additional watershed land to the ridgelines; provide trail extensions.
• Hydrology and water quality	Potential erosion during construction. Beneficial effect on water supply availability. Improved flexibility in meeting flow requirements in lower Mokelumne River.	Use appropriate methods to control erosion.
•Geology and soils	No active faults pass through dam site.	Use appropriate technology to protect soils; design dam to resist maximum credible earthquake.
• Vegetation and wildlife	54 acres of riparian vegetation inundated; Aleutian Canadian goose found near dam site.	Enhance riparian habitat on other watershed land.
•Traffic disruption	Pipeline construction in Castro Ranch Road; relocation of Pinole Valley Road.	Appropriate traffic controls and detours as needed.
• Construction traffic	Temporary increase in traffic: Pinole Valley Road 12%; Castro Ranch road 2%; I-80 1%.	Road improvements and relocation of 5.6 miles of Pinole Valley Road.
• Noise and air quality	Equipment noise; dust during construction.	Mufflers on equipment. Dust suppression.
• Cultural resources	One potential site.	Exploratory site excavation; recording prior to completion of project.
• Visual quality	Permanent change in appearance of site.	Consider esthetics in design of dam and other facilites.
• Public health and safety	Unquantifiably small risk of dam failure. Will reduce shortages caused by drought or outage.	Design dam to resist maximum credible earthquake.
• Growth inducement	Will provide capacity for development planned and permitted by cities and counties.	None required.

BUCKHORN RESERVOIR		
POTENTIAL ENVIRONMENTAL EFFECTS		MITIGATION
• Land Use	1124 acres of cattle grazing land converted to body of water	Acquire additional watershed land to the ridgelines; provide trail extensions.
• Hydrology and water quality	Potential erosion during construction. Beneficial effect on water supply availability. Improved flexibility in meeting flow requirements in lower Mokelumne River.	Use appropriate methods to control erosion.
•Geology and soils	No active faults pass through dam site.	Use appropriate technology to protect soils; design dam to resist maximum credible earthquake.
• Vegetation and wildlife	34 acres of riparian vegetation inundated; No rare or endangered species found.	Enhance riparian habitat on other watershed land.
•Traffic disruption	Pipeline construction in St. Mary's Rd., Moraga Rd., Canyon Rd., and Camino Pablo.	Appropriate traffic controls and detours as needed.
• Construction traffic	Temporary increase in traffic: Redwood Rd./Castro Valley 15%; Castro Valley Blvd. 2%; Moraga 1%.	Schedule time of traffic; coordinate with cities and counties.
• Noise and air quality	Equipment noise; dust during construction.	Mufflers on equipment. Dust suppression.
• Cultural resources	Two potential sites.	Exploratory site excavation; recording prior to completion of project.
• Visual quality	Permanent change in appearance of site.	Consider esthetics in design of dam and other facilites.
• Public health and safety	Unquantifiably small risk of dam failure. Will reduce shortages caused by drought or outage.	Design dam to resist maximum credible earthquake.
• Growth inducement	Will provide capacity for development planned and permitted by cities and counties.	None required.

LOS VAQUEROS RESERVOIR		
POTENTIAL ENVIRONMENTAL EFFECTS		MITIGATION
• Land Use	1200 acres of cattle grazing land converted to body of water.	Acquire additional watershed land to the ridgelines; provide trail extensions.
• Hydrology and water quality	Potential erosion during construction. Beneficial effect on water supply availability. Improved flexibility in meeting flow requirements in lower Mokelumne River.	Use appropriate methods to control erosion.
•Geology and soils	No active faults pass through dam site.	Use appropriate technology to protect soils; design dam to resist maximum credible earthquake.
• Vegetation and wildlife	Important plant species would be affected.	Enhance same plant life elsewhere.
•Traffic disruption	Pipeline construction.	Appropriate traffic controls and detours as needed; road improvement and relocation.
• Construction traffic	Temporary increase in traffic: Vasco Rd., Marsh Creek Rd., and Camino Diablo.	Schedule time of traffic; coordinate with cities and counties.
• Noise and air quality	Equipment noise; dust during construction.	Mufflers on equipment. Dust suppression.
• Cultural resources	Potentially significant sites.	Exploratory site excavation; recording prior to completion of project.
• Visual quality	Permanent change in appearance of site.	Consider esthetics in design of dam and other facilites.
• Public health and safety	Unquantifiably small risk of dam failure. Will reduce shortages caused by drought or outage.	Design dam to resist maximum credible earthquake.
• Growth inducement	Will provide capacity for development planned and permitted by cities and counties.	None required.

PRELIMINARY CONCLUSIONS

The following discussion summarizes the preliminary staff conclusions. Final staff conclusions and recommendations require consideration of additional information that may be presented during the public review process.

Security

1. A 13-month outage of the Mokelumne supply due to a major earthquake damaging the aqueducts across the Delta is a significant risk with a frequency estimated to be more than once in 100 years (significantly less than the life of the aqueduct).

2. Basic improvements in the Delta, including continuation of the levee repair program and preliminary engineering for aqueduct replacement, would help prepare for a disaster; however, they would not protect against severe rationing during a 13-month outage.

3. Water banking by constructing additional terminal storage would provide for EBMUD's security needs by being available to deliver water to the District's customers during an outage of the Mokelumne supply. With a projected demand of 270 MGD in 2020 and the limit of 39 percent on rationing, 100,000 acre-feet of additional storage would be needed. With a limit of 25 percent on rationing, 145,000 acre-feet would be needed.

Terminal Storage

4. Of the District-owned sites, the best from the standpoint of capacity, water quality, efficiency, reliability, watershed protection, open space, trail and ridgeline enhancement and protection is the Buckhorn site. It must be evaluated by studying all of the issues addressed in this report. Each terminal reservoir has the effects outlined on pages 27 and 28. The District will weigh the negative effects against the long-term benefits of water banking and quality protection.

Shortage

5. Water conservation and water reclamation are an important part of water supply management. Additional conservation measures and reclamation projects are feasible.

6. The increased efficiency of water use resulting from water conservation would not significantly reduce shortages in dry periods.

7. Water banking in normal and wet years by constructing additional terminal storage could reduce shortage in dry periods and limit restrictions to 25 percent during a drought. With a projected demand of 270 MGD in 2020 and the limit of 39 percent on rationing, 55,000 acre-feet of additional storage would be needed. With a limit of 25 percent on rationing, 95,000 acre-feet would be needed. These quantities are less than those needed for security (see above); therefore, the quantity required for security would govern the size of additional terminal storage.

8. The District's Water Supply Availability and Deficiency Policy was designed to meet a drought like 1976-77 with no greater rationing hardship than experienced in 1977. In recent years, the increased water use efficiency means that the 39 percent 1977 reduction level will have a greater impact. To be consistent with the District's objectives, this percentage should be reduced to 35 percent, and since no new storage has been constructed since the 1960's and existing customers are at greater risk than the District has historically experienced, the percentage should be significantly reduced with a 25 percent limit on dry-year deficiency.

9. These conclusions assume that terminal storage is justified on either security or shortage grounds but not both at the same time. A significant argument could be made that a moderate drought when combined with more frequent Delta failures of lower magnitude could result in the same or greater impact than one or the other risks individually. The District and other utilities have traditionally planned conservatively when making capital investments since the incremental costs of a major investment is small compared to its benefits.

Safety and Health

10. Monitoring and controlling activities affecting the Mokelumne and terminal reservoir watersheds has been effective in helping to provide high quality water.

11. The purchase of additional watershed lands to the ridgelines around the existing and any proposed terminal reservoirs would help assure that the high quality of stored water can be maintained into the future, and have other significant public benefits.

12. The treatment improvement program will assure that water quality will meet new drinking water standards and water treatment operations will be improved; continued studies of advanced treatment technologies may decrease the use of chemicals and further improve water quality.

ALLOCATION OF COSTS

Program Costs

The Summary Table on the back cover shows the several elements of the proposed Water Supply Management Program. Except for additional terminal storage, these costs would be paid through water rates and would be reflected in the billing for water service during the period of debt service for bond-financed capital improvements or during the period of expenditure for direct costs. The cost of additional terminal storage would be paid through both the water rates and the system capacity charge (SCC) paid by each new customer when connected to the water system, as discussed below.

The percentage increases shown in Table 13 are based on the average water use of a residential customer with a single family home and have been determined for the middle of the period over which the expenditures are estimated. Only the share of the capital costs to be covered by water rates was used in determining the rate impact. The balance of the capital costs are covered by the SCC and other charges paid by new customers when connected to the system. The average water use at a single family home in the District is about 320 gallons per day, which is 26 units on a bimonthly water bill. (A unit is one hundred cubic feet of water or 748 gallons.)

Terminal Storage

The cost of additional terminal storage varies with the alternative project sites and the size of the reservoir to be constructed, as shown in Table 12. The allocation of cost is a two-step determination as summarized in Figure 25:

The first step is allocation between security and shortage (drought) which are overlapping benefits in the use of the additional storage capacity. The allocation percentages are based on sharing a capacity equal to that required for shortage at 270 MGD in 2020 (the lesser capacity required) and assigning the balance to security (the greater capacity required). In the case of the 145,000 acre-foot reservoir, the first 95,000 acre-feet (66%) is half for shortage and half for security (33% each); the remaining 50,000 acre-feet (34%) is entirely for security. Thus the total project cost is allocated 33% to shortage improvements and 67% (33% + 34%) to security improvements.

The second step is allocation between existing customers as of 1988 and new customers beginning in 1989,as governed by the size of the reservoir, which is directly related to the limit on demand reduction (rationing) during a drought or extended water supply outage. The allocations for 100,000 and 145,000 acre-feet of additional storage are shown in Figure 25. In the case of the 145,000 acre-foot reservoir at 2020 levels of demand, the shortage improvement is entirely for new customers and therefore the 33% of total project cost is so allocated. The security improvement needed for existing customers requires 93,000 acre-feet to supplement the existing standby storage capacity, thus 93/145 of 67%, or 43% of the total project cost is assigned to existing customers for security. New customers require 52,000 acre-feet for security, thus 52/145 of 67%, or 24% of the total project cost is so assigned.

The net result is the bottom line allocation of costs to existing and new customers as shown in Figure 25.

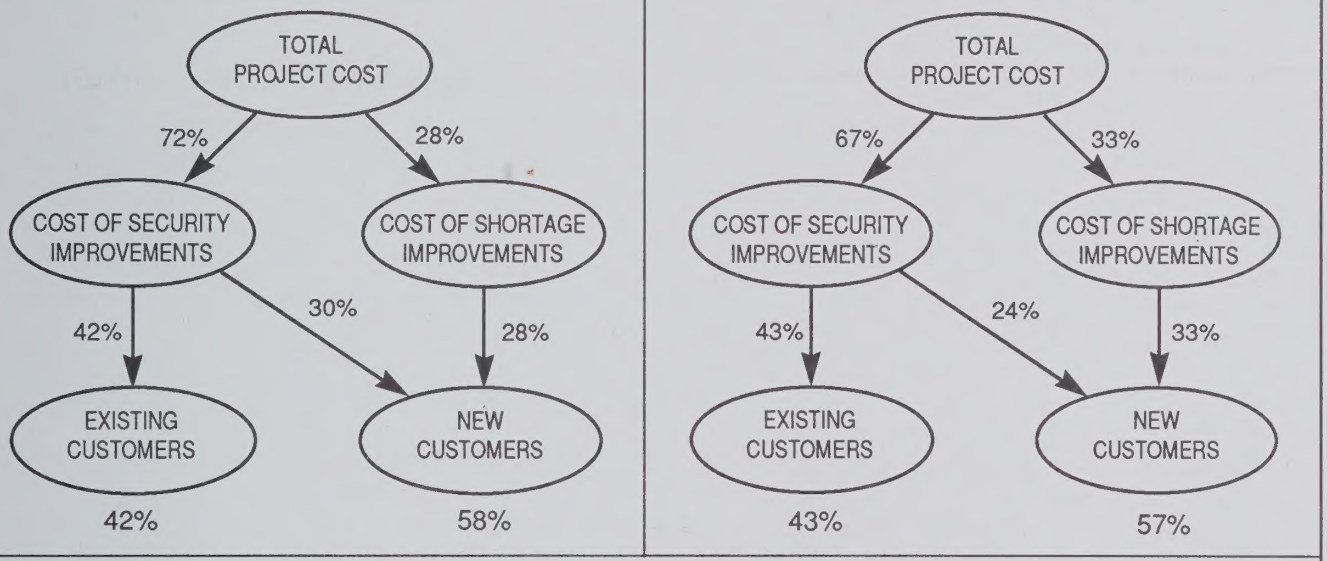
The water rate increase would be as shown in Table 14. It would be paid by existing customers for the benefit they receive and would also be paid by new customers from the time they begin receiving water service. The SCC would also be as shown in Table 14. The calculation of the SCC assumes a credit for the water rate paid by the new customers.

TABLE 13. CAPITAL PROGRAM

AVERAGE COST TO RATEPAYERS

	CAPITAL COST (1988$)	RATE IMPACT BOND DEBT LIFE % OF WATER BILL
WATER SUPPLY MANAGEMENT PROGRAM CAPITAL PROGRAM:		
Water Banking	$152 M	1.6%
Watershed Enhancement	20	0.2
Treatment Improvements	35	0.6
Delta Levee Improvements	10	0.2
ONGOING CAPITAL PROGRAM:		
Distribution Improvements	130	0.6
Building Modernization	70	1.5
TOTAL	$417 M	4.7 %

FIGURES 25. ALLOCATION OF OF TERMINAL STORAGE COST



The allocation of cost by type of improvement and by customer group depends on the limit on rationing duriring a drought or supply outage, which determines the amount of new storage needed. The existing policy includes a 39% limit on rationing.

TABLE 14. IMPACT ON WATER RATES AND SCC

100,000 ACRE - FOOT RESERVOIR (39% LIMIT ON RATIONING)

TOTAL COST (1988$): $120 MILLION
Financing by Revenue Bonds

EXISTING CUSTOMERS (42%): $50 MILLION
Water Rate Increase $0.048 Per Unit*

NEW CUSTOMERS (58%): $70 MILLION
Pay Same Water Rate Increase

System Capacity Charge (SCC)
for 5/8-inch Meters (Typical Single Family)

REGION	SCC 7-1-88	ADDITIONAL SCC 1989	2020
1	$760	$770	$940
2	795	890	1090
3	885	890	1090
4	1560	890	1090
5	2160	1020	1250
6	3260	1530	1870
7	4850	1790	2190

NOTE: Escalation of Costs will Increase the Charges.
*A Unit is One Hundred Cubic Feet or 748 Gallons

145,000 ACRE - FOOT RESERVOIR (25% LIMIT ON RATIONING)

TOTAL COST (1988$): $152 MILLION
Financing by Revenue Bonds

EXISTING CUSTOMERS (43%): $65 MILLION
Water Rate Increase $0.063 Per Unit*
(Also see Table 13)

NEW CUSTOMERS (57%): $87 MILLION
Pay Same Water Rate Increase

System Capacity Charge (SCC)
for 5/8-inch Meters (Typical Single Family)

REGION	SCC 7-1-88	ADDITIONAL SCC 1989	2020
1	$760	$940	$1170
2	795	1100	1360
3	885	1100	1360
4	1560	1100	1360
5	2160	1250	1560
6	3260	1880	2340
7	4850	2190	2730

NOTE: Escalation of Costs will Increase the Charges.
*A Unit is One Hundred Cubic Feet or 748 Gallons

SUMMARY TABLE: PROPOSED WATER SUPPLY MANAGEMENT PROGRAM

OBJECTIVE	PROGRAM	ACTION	COST	TIMING
SECURITY: Protect against floods and earthquakes	Water Banking (additional terminal storage)	Construct new terminal reservoir (145,000 acre-feet)	$152 to $185 million	In service in 1995
	Levee and Foundation Improvements in the Delta	Continue repair, maintenance and upgrading of levees	$8 million	Complete by 1991
		Preliminary engineering of levee reinforcement and pipeline supports	$2 million	Complete by 1995
SHORTAGE: Supply to meet water demands in dry periods	Water Banking (additional terminal storage)	Construct new terminal reservoir (145,000 acre-feet)	$152 to $185 million	In service in 1995
	Water Conservation	Implement additional measures and continue existing program	$0.6 million per year	Implement immediately
	Water Reclamation	Develop new reclamation projects and continue existing program	$15 million	Implement immediately
SAFETY AND HEALTH: Maintain high quality water	Enhance Watershed Lands of Terminal Reservoirs	Purchase additional watershed lands to the ridgelines	$20 million	Complete by 1995
	Treatment Improvement Program	Continue treatment plant modernization and improvements	$35 million	Complete by 1992

SCHEDULE

Report Review Period

The review period for this summary, the technical report, and the Draft EIR will end on June 17, 1988. Copies of the technical report and the Draft EIR are available from the EBMUD Office of Planning, 2127 Adeline Street, Oakland, CA 94623, telephone number (415) 835-3000, ext. 557.

Submit written comments by June 17, 1988 to:

Richard L. Kolm
Asst. Chief Engineer for Planning
EBMUD, P. O. Box 24055
Oakland, CA 94623

Public meeting conducted by staff:

Wednesday, May 18, 7:30 p.m.
EBMUD ADMINISTRATION CENTER
2130 Adeline Street (at West Grand Avenue)
Oakland, California

Public hearing by EBMUD Board of Directors:

Wednesday, May 25, 7:30 p.m.
KAISER CENTER AUDITORIUM
300 Lakeshore Drive
Oakland, California

EBMUD BOARD DECISIONS

Preliminary conclusions of EBMUD staff regarding a proposed Water Supply Management Program are summarized in the chart at the top of this page. After extensive review of the technical findings and after considering public comment received through the review process described in the column at the left, the EBMUD Board will make a series of decisions:

1. Should the current Water Supply Availability and Deficiency Policy continue to assume 39 percent rationing in a repeat of a drought like 1976-77, with a voluntary reduction of 25 percent in the last half of the first year; or, is it more prudent to assume an improved level (25%) with no voluntary reduction in the first year?
2. What combination of acceptable and feasible conservation and reuse activities --- in addition to present efforts --- will provide a desirable increase in water use efficiency?
3. Is water banking with the construction of additional terminal storage the solution to the problems of security and shortage of the water supply?
4. If water banking is the solution, what amount of storage is needed and what specific project best meets that need?